

Every man in the class knew the answer



PROFESSOR HASKINS. . . . WAS A kindly soul. . . . BRIGHT ON some subjects BUT 50 absent-minded. THAT ONE day at the barber's. . . . HE TOOK off his collar. . . . TO GET shaved. . . . AND FORGOT where he was. . . . AND KEPT right on. TILL THE cash girl screamed. AND A barber stopped him. HE WAS a great amoker. E 2 E BUT HE'D often put. 0 0 0 THE BURNT match in his mouth. AND THROW away. THE GIGARETTE. HIS STUDENTS loved him. . . . HE WAS to I'ull. * * * OF FUNNY surprises. ONE DAY be had a tube. OF RADIUM and he told. THE STUDENTS all about it. . . . AND FINALLY, by mistake.

INSTEAD OF the tube. . . . HE PULLED out one. . . . OF HIS cigarettes. . . . AND ASKED the class. . . . "WHAT IS the one thing. WHICH DISTINGUISHES. THIS MARVELOUS substance. . . . FROM ALL others on earth?" AND THE class rosred. "THEY SATISFY," . . .



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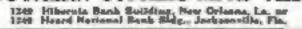
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Popular Science Monthly OCT., 1920 Volume 97-No. 4

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How I Improved My Memory In One Evening

The Amazing Experience of Victor Jones

OF course I place you! Mr. Addison Sims of Scattle.

If I remember correctly-and I do rememher correctly -Mr. Burroughs, the lumberman, introduced me to you at the lancheon of the Seattle Rotary Club three years ago in May. This is a pleasure indeed. I haven't last eyes on you since that day. How is the grain on you since that day. How is the grain business? And how did that amalgamation work out?"

The assurance of this speaker -in the crowd-id corridor of the Hotel McAlpin -compelled me to turn and look at him, though I must say it is not my usual habit to "listen in" even in

a hotel lobby. "He is David M. Roth, the most famous

memory expert in the United States," said my friend Kennedy, answering my question before I could get it out. "He will show you a lot more wonderful things than that, before the evening is ower." evening to over."

And he did.

As we went into the banquet zoom the togstmaster was introducing a long line of the guests to Mr. Roth. I got in line and when it came my turn Mr. Roth asked, What are your ini-tials, Mr. Jones, and your business connection and telewhy he asked this I learned later, when he picked out from the crowd the 00 men he had met two house

before and called each by name without a misness and telephone number, for good measure.

I won't tell you all the other amazing things this man did except to tell how he called back, without a minute's hedtation, long lists of numbers, bank clearings, prices, lot numbers, purcel post rates and anything else the guests gave him in rapid order.

When I met Mr. Roth-which you may be sure I did the first chance I got-he rather bowled me over by saying, in his quiet, modest

There is nothing miraculous about my remembering anything I want to remember, whether it be names, faces, figures, facts or something I have read in a magazine.

"You can do this fast areasy or I do, Any one

with an average mind can learn quickly to do exactly the same things which seem so mirac-

"My own memory," continued Mr. Roth,
"was originally very faulty. Yes, it was -a
really poor memory. On meeting a man I would lose his name in thirty seconds, while now there are probably 10,000 men and women in the United States, many of whom I have met but once, whose names I can call instantly on meeting them.

"That is all right for you, Mr. Roth," I interrupted, "you have given years to it. But

how about me?"
"Mr. Jones," he replied, "I can teach you the secret of a good memory in one evening. This is not a guess, because I have done it with thousands of pupils. In the first of seven sim-ple lessons which I have prepared for home study. I show you the basic principle of my whole system and you will find it-not hard

work as you might fear—but just like playing a fascinating game. I will prove it to you. If e didn't have to prove it. His course did;

I got it the very next day from his publishers, the Independent Corporation.

When I tackled the first lesson, I suppose I was the most surprised man in forty eight states to find that I had learned in about one bow, how to remember a list of one hundred would so that I could call them off fortuned and words so that I could call them off forward and

tack without a single mistake. That first lesson stock. And so did the other str.

Read this letter from Terence J. McManus, of the firm of Olcott, Bonyage, McManus & Ernst, Atterneys and Counsellers at Law, 120

mind and see instantly everything you want to remember.

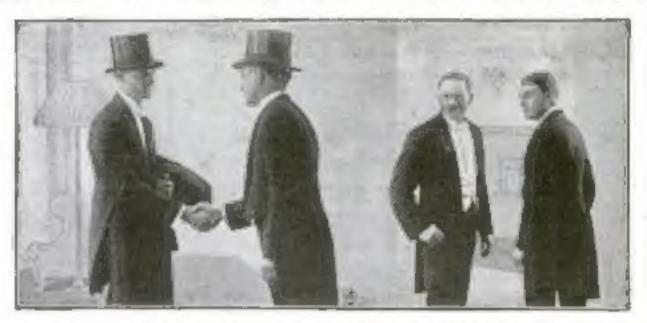
This Roth course will do wonders in your

Since we took it up you never hear anyone in our office say "I green" or "I think it was about so much" or "I forgot that right now" or "I can't romember," or "I must look up his name."

Now they are right there with the answer like a shot,

Have you ever heard of "Multigraph Smith?" Real name H. Q. Smith. Division Manager of the Multigraph Sales Company. Ltd., in Montreal. I must be in just a bit from a

letter of his that I new hast week!



"Of Course I Place You! Mr. Addison Sims of Seattle."

Broadway, and one of the most famous trial lawyers in New York:

"May I take on arises to state that I regard rout persise in giving this rymon to the world as a public bringly into the second of the mental and the method and the mental and the may be a cored to be so to be the the offers on a quite filled (we) to make the other than the offers of an appearance of the person of the person of the corporation arising the which I am about to vigage."

Mr. McManus didn't put it a bit too strong. The Roth course is priceloss, I can absolutely need on my memory now. I can absolutely need on my memory now. I can call the name of most any man I have met before—and I am getting better all the time. I can remember any figures I wish to remember. Telephone numbers some to mind instantly, once I have filed them by Mr. Roth's casty method. Street addresses are included.

addresses are just as casy.

The old fear of forgetting (you know what that is) has vanished. I used to be "scared stiff" on my feet-because I wayn't save. I

couldn't remember what I wanted to my.

Now I am sure of myself, and consident, and
"easy as an old shoe" when I get on my feet at the club, or at a banquet, or in a business meeting, or in any social gathering.

Perhaps the most enjoyable part of it all is

that I have become a good conversationalistand I used to be as silent as a sphins when I got into a crowd of people who knew things,

Now I can call up like a dash of lightning most any fact I want right at the instant I need it most. I used to think a "hair trigger" memory belonged only to the prodicty and genius. Now I see that every man of us has that kind of a memory if he only knows how to make it work right.

I tell you it is a wooderful thing, after groping around in the dark for so many years to be able to switch the big searchlight on your Here is the whole thing in a nucleich. Mr. Poth has a most remarkable Memmy Course. It is ample, and eney as falling off is lost the whole a day of practice, anyone—I don't thin who he is memory [1997, in a week and [1997, in a population.

My advice to you is don't wait another Send to at Cor-for Mr. minute. Independent Roth a amoring course and see what a wonderful memory you have got. Your dividends in increased your will be enor-Microst.

VICTOR JONES.

While Mr. Jones has charen the story form for this measured of his paperthis measured of his paperprinted with Holland Managery
with the Rolls Managery
County, he has used puty
facts that new houses persistently in the Previous of the
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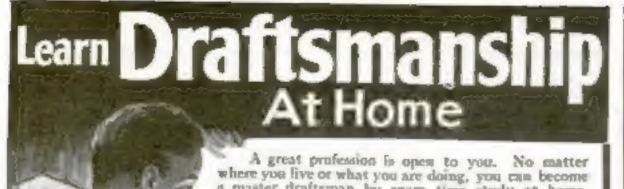
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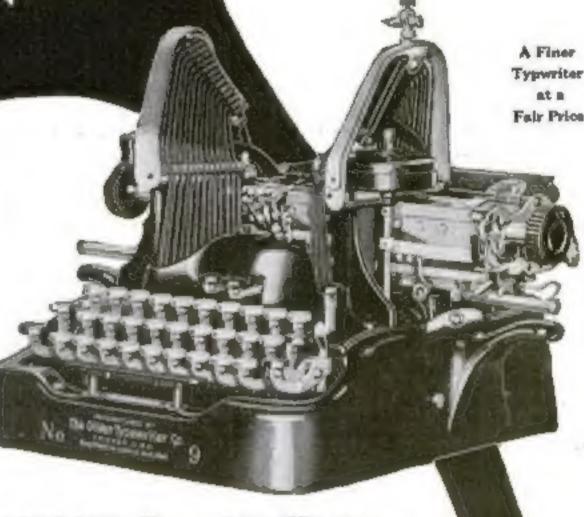
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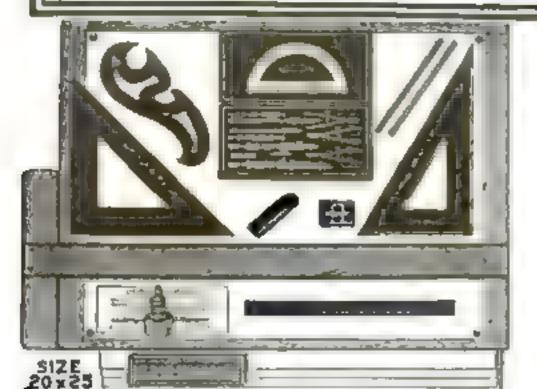
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"You've Gone Way Past Me, Jim!"

"Today good old Wright come to my office. All day the boys had been dropping in to congratulate me on my promotion. But with Wright it was different

"When I had to give up school to go to work I came to the plant seeking any kind of job. I was just a young fellow without much thought about responsibility. They put me on the payroll and to med me over to Wright, an assistant foreman then as now. He took a kind vimit crest at me rom the first. "Do we I the job that's given you, lad, he said, and in time you II will out."

"Well, I did my best of my contine work but I soon realized that if ever I was going to get ahead I must not only do my work well but prepare for something better. So I wrote to Scranton and frame I could get exactly the course I needed to learn our business. I took it appear I began such up as hour or two each evening.

Why, in just a little while my work took on a whole new meaning. Wright begin giving me the most particular jobs saint asking my advice. And there came, also an increase of pay. Next thing I knew I was made assistant foreman of a new department. I kept right on studying her just I could see results and each day I was applying what I council. Then there was a change and I was promoted to foreman—at good money, too.

'And now the first big goal is reached -I im superintendent with an income that means independence coefficies and enjoyments at home all those

things that make life worth hy ng

Wright is a last the same toll an example of the tragedy of lack of training. What a truth he apoke when he and I slav "You've gone way past me, Jim,—and you deserve to. Heads win every time"

Yes, it's simply a question of training. Your hands can't carn the money you need, but your head can if you'll give it a chance.

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Secrets of Selling that Make These Men \$10.000 a Year

Some Amazing Stories of Quick Success

T is hard to believe that a mgp who has been working for years in a routine job at a nall pay could il tost overnight step into the \$10,000 a year class. Yet that is past what many men have done and are doing today. That such placet mored tile. Di should to you that one man who had been a fremus on a rational suppose from his oil job to one thas our to \$ 1.00 a year, say work be a fire fromoubt the truth of my statement

Bur I can show you the man a own story. And that is only one meta see. can show you many more. And perhaps the most suspensing part of it

ah ia that these men were just average men. They came from all walks of the from adfields of work. They had previously been cleries, bookkeepers, mechanics, form bands! Same of them had never earned more than \$60. month -some of them has drudged for years at our an attresting work without prospects of any hing better in He then in one quick jump, they found themselves earning more money than they had ever thought possible. Suddenly all their greatus of success, position and financial independence came vrue.

The Secret of Their Success

What was responsible for their remarkable to the ranks of the big maney makers? What did they do to lift themselves out of the low pay rut and step to magnificent earnings?

The answer is very simple. These men decided to get into the great field of Selling—they learned about the wonderful opportupeties us this fascisating profession-why salesmen are always in demand - why they rereive so much more money than men in other fields of work. And they became Star Sales-

Probably if you had told any one of these men that it was possible for him to become a Star Salesman he would have laughed at the idea. If you had told him that it was not only possible, but that it could be done in his space moments at home, without interfering with his work, he would have dismissed your etatement as being too absord to be even considered. For you must remember that most of those men have never had a day's Expenence in Selling-they had no special qualifications for Salesmanning—no thought of ever becoming Solesmen.

What Makes 4 \$10,000 a Year Star Salesman?

As a matter of fact, these men who are today reaping such handsome rewards as Star Salesmen, would probably be working still as cieria, bookkeepers, mechanics, etc., if they had not learned about the National Solesmen's Training Association's system of



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I have above hundreds of more law to stop from small pay jake onto the log money class in one quark pures. \$79,000

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who tell in their own words what the Association has done for them. Here are part a few examples.

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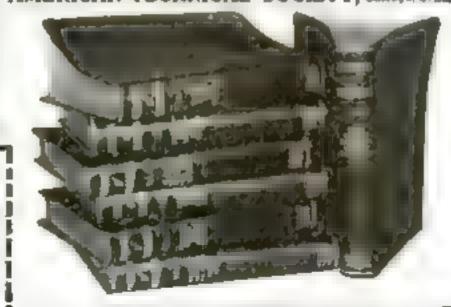
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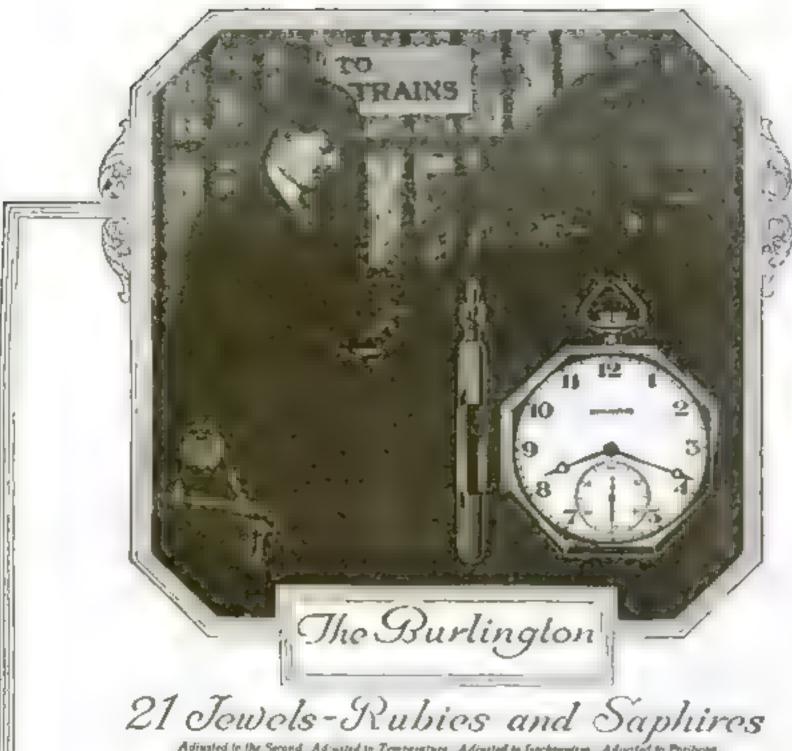
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Popular Science Monthly

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Published in New York City at 225 West Thirty-ninth Street

A Crater Big Enough to Hold New York and Philadelphia

It's on the moon and it's not the largest, either

By Latimer J. Wilson

THE easiest way to illustrate the making of craters is to fry a cake of batter and watch the plastic mass as the bubbles of escaping steam burst. There, in its surface, are innumerable craters!

Look at the moon through a small telescope when the phase is near the first or the last quarter, and you will see similar circular depressions filled with shadows.

"The moon's face is pitted with holes?" exclaims the visitor to the observatory.

Then take the visitor up in an airplane and show him craters in the ground made by the shells in the devastated region of "No Man's Land." Again he exclaims

"These shadow-filled pita look like the craters on the moon!"

The comparison is certainly striking, as one can see by comparing photographs of the earth's devastated area in the battle zones with the visible hemisphere of the moon. There is, of course, the great difference in size of these formations, but the moon's craters reach beyond the hundred mile mark in diameter, while the largest earth-crater does not reach a

diameter of fifteen inites. The explosive violence necessary to produce such gigantic formations would be required to increase their force manyfold before such depressions could have even been formed on the earth, because the force of superficial gravity on the earth is six times greater than that on the moon.

The moon's atmosphere during the period of the shaping of lunar scenery must have been a negligible factor to offer resistance to the volcanic forces of propulsion. It has been

calculated that with the lessening of atmospheric medium of resistance, and with the lesser superficial gravity, volcanic eruptions on the moon could have formed the ringed walls of the lunar craters on the huge scale we now behold them.

Artificial craters are made in ininiature every time batter or griddle cakes are fired. The formation of steam produces little explosions and such on a creates a tiny crater in the surface of the cake

If all of the lunar circular formations had conclike peaks in their center, and if the opening, or chimney through which the erupted material was ejected, could be seen, there would be tittle hesitancy in saying that all of the moon's formations were the result of volcanic activity on a gigantic scale. But some of the craters have no central cone, and as yet no telescope has shown the vent in any of the central peaks through which ejected matter could have been thrown, though there are small craters near the center of

large ones. Many of them are great circular plains walled in by high mountains.

What a fantastic picture the moon must have presented in the days of its crater-making! In the frigid region of space through which the planets

> move, it must have cooled comparatively quickly. Projectiles of solid matter, rock and metallic fragments must have been fired into the sky with enormous force. Some of these particles fell back upon the moon and piled up lofty mountain rings. Other masses, perhaps, were sent outward in such a manner that they became distinct bodies which even to the precent time swing around in the solar mystem in orbits of their own. Possibly some of the bolides, the meteorites that dash with explosive force into the air, are fragments of early lunar volcanic activity. How funtantle the idea of our being able to lay hands upon one of the huge iron meteorites in the museum and to say, "Perhaps this heavy mass is a part of the moon!"

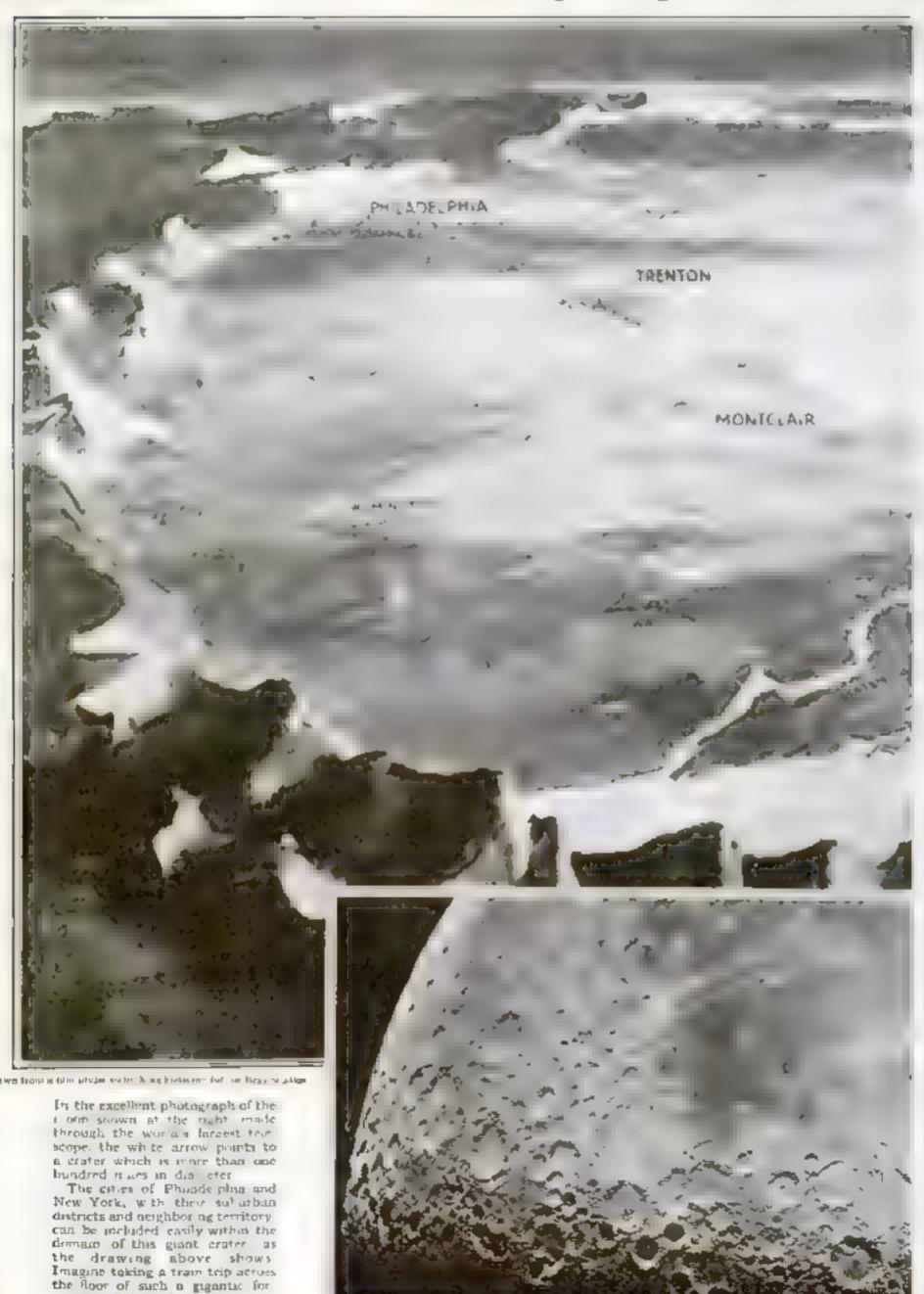
Take a "close-up" view of one of the moon's vast formetions. Near the center of the hemisphere that faces the

earth are several of the largest. One of these, about one hundred miles in diameter, has no central peak, but consists of a surrounding wall of mountains. There are small blowholes to be seen upon the floor of this circular plant.

Now, if we picture this great ring of mountains on the earth, the city of Philadelphia could be built at one side and the whole of New York at the other, with the country between.

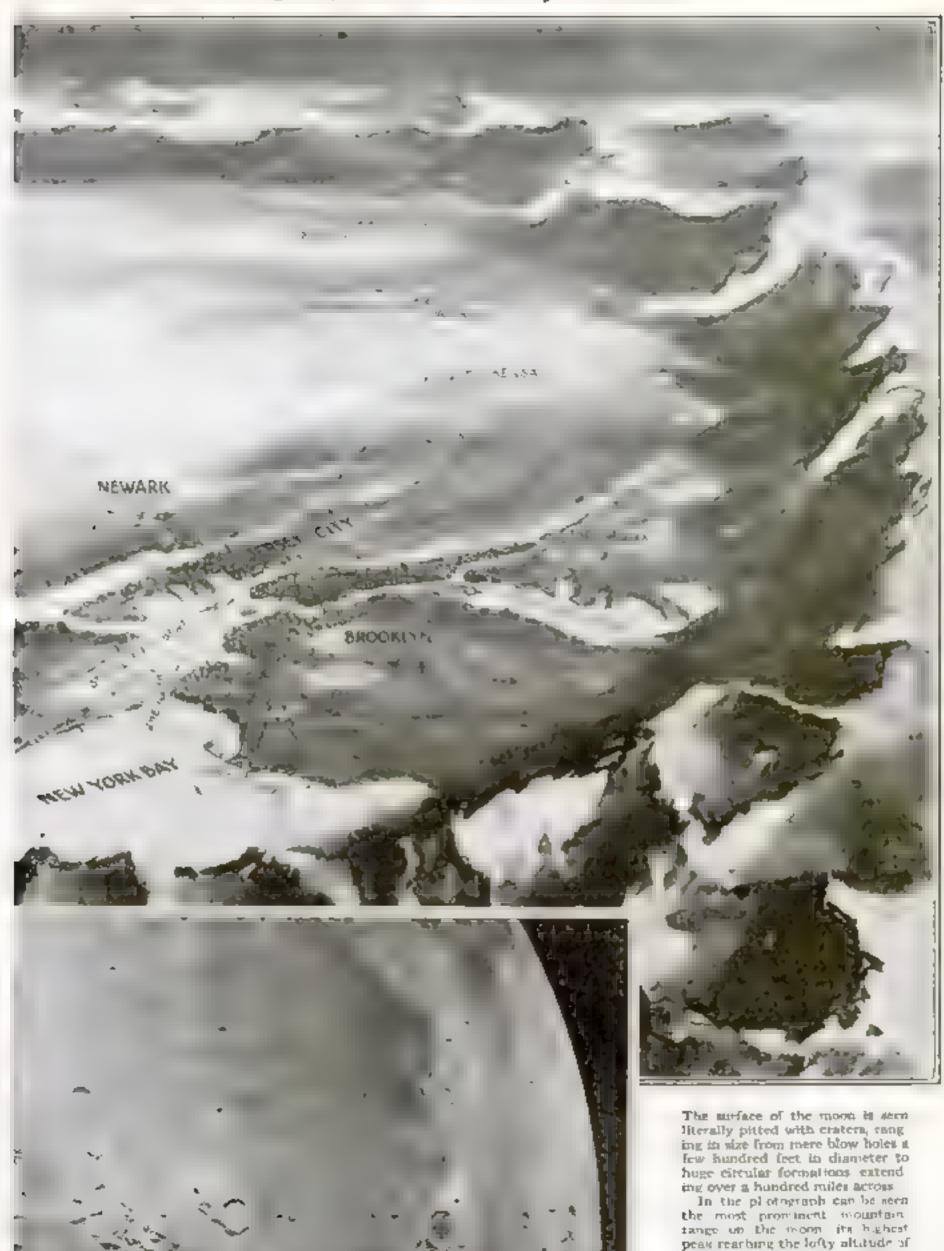
The pictures on the following pages give a clear idea of this.

This moon crater is large enough to accommodate



mation. Only in this way is it postible to obtain an idea of its size

New York, Philadelphia, and the country between



Phonograph by Samuel Walson Soler Observatory

remer than 16 MM feet. What a remarkable sight would greet a person who stood upon the n

of meantains surrounding a large crater and looked across the valley, watching the sunrise upon the distant peaks!

The Undying Lure of Perpetual Motion

Like truth crushed to earth, the old, old fallacy rises again. Here we tomahawk it once more

By Philip Rowland

'N the early middle ages the perpetunia mobile, which means "an everlasting moving thing," or, with a alight stretch in correct translation, "a thing that moves forever," was launched upon a long but inglorious career by philosophers who knew Latin better than mechanics or physical science. The problem that the phrase was supposed to represent took hold of the imagination somewhat as did the other two problems, known us the trisection of an angle and the squaring of the circle, which also date back to antiquity.

It was not easy to prove that these problems cannot possibly be solved, and therefore are not problems at all. because those who were willing to tackle the problems were not sufficiently gifted to understand the proof of demonstration. Never being solved, the problems drifted down the corridoes of time, and the interest in them spread from those with a smattering of learning to all classes of the popula-

tions of Europe.

The impossibility of solution advertused the problems. The problems in geometry never became so popular, of course, as that of perpetual motion, which any mechanic or amateur could hope to solve by inspiration, and for the solution of which it was rumored kings and governments and prince lings had offered buge rawards.

Owing to its origin among philosophers who cared more for the principle than for practical utility, the perpetual motion idea was started in a bud groove of thought. It was considered sufficient to make a little toylike thing, a t ny machine, which, once started, would keep on running. overcoming its own friction resistance but doing no useful work otherwise.

If this could be done, it was held, a large machine constructed on the same principle would be certain to do much more. It was overlooked that the hapless enthusiast who started ou! on this plan, aiming only for a very slight surplus of power to operate the chimera, would be dealing with forces too small for measurement by any ordinary means and would be likely to delude himself at every step with over-hopeful guesswork in favor of the scheme he had once adopted as a promising one. The germs of failure by reason of their microscopic dimensions would remain hidden to his not overly sagacious mand, just as the bacilli of disease, being invisible to the naked eye, escaped the attention of

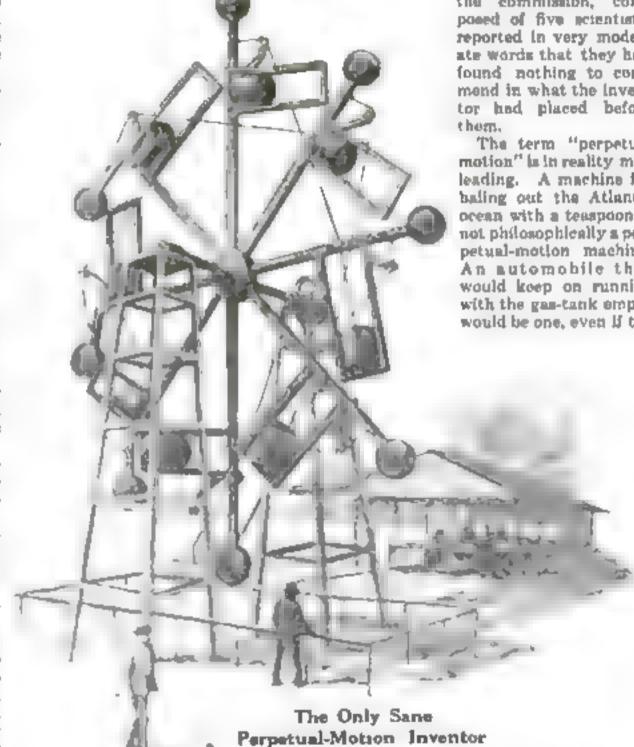
the medical profession far into the middle of the nineteenth century.

As late as 1917 a great stir was made over the so-called Garabed machine, which nobody but the inventor had seen, but which was represented as capable of turning a shaft continuously without using fuel, thereby creating free energy. Special protec-

tion was granted for this invention by Congress, and an investigating commission was appointed to take due note of what there was to protect. It was not made clear whether the Garabed was really to be classed as a perpetual-motion machine or was intended to draw energy from the atmosphere in some mysterious manner

> heretolore unknown; but the commission, composed of five actentuate, reported in very moderate words that they had found nothing to commend in what the inventor had placed before them. The term "perpetual

motion" is in reality misleading. A machine for baling out the Atlantic ocean with a teaspoon is not philosophically a perpetual-motion machine. An automobile that would keep on running with the gas-tank empty would be one, even if the

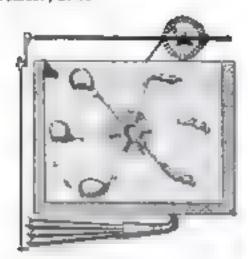


Jennics Berguson, a fellow of the Royal Scenety, devised this muchine—but for the laudable purpose of laying bure the utter fallacy of perpetual motion.

Jointed spokes with heavy balls at the ends radiate from a borseontal shaft. To each spoke is secured a rectangular frame in which a weight slides. It is clear that, as a spoke swangs down to a horizontal position, the weight in the frame drops, pulling straight out by means of a curd, as it does so,

the ball at the end of a spoke the spokes swing around to the left the weights in the frames drop book and cease pulling, so that the spokes bend at their joints, and the bails at their ends move inward.

Says Ferguson As the balls or weights at the right hand side are farther from the center than they are at the left, it might be supposed that this machine would turn tound perpetuall. But who ever makes it win find it to be only a mere balance."



"Worked" by Buoyancy

A bollow shaft, bollow arms, wrighted bellows at the ends of the arms, acrew valve throttles in the arms super fluous, but showing how the inventor tustied to get it all just right

The bellows enter the water compressed by the weights, the opposite bellows receiving the air through the airs and expanding to make room for it, its expansion giving them buryancy to turn the wheel.

It is not a high speed engine, due partly to the resistence of the water and partly to the fact that it requires more power to expand the bellows under water than can be recovered by buoyancy. Each expansion must drive the water a little higher to the tank

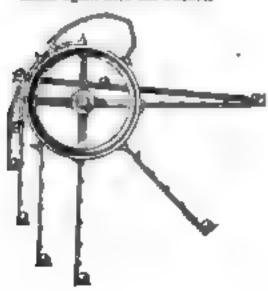
Levers and Balls

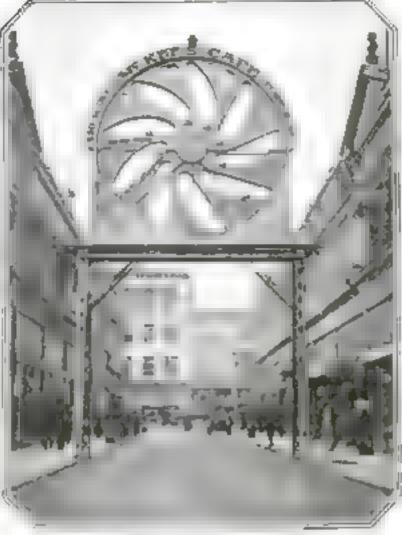
Imagine a series of wheels of which that shown below is one. One sever is in the act of failing from the periphery of the wheel into the right line.

Note that the lever is corn posed of a series of jointed flat rods, provided with a stop to prevent their collapsing at any timemore than enough to bring any one of the rods at a right angle with the rod next to it.

The lever is hinged to the periphery of the wheel in such a way as to prevent its failing into any other than a right line from the center of the circumference of the wheel.

Each lever has a bucket at its outer extremity the bottom bring sufficiently broad to retain a ball. The balls are supposed to roll out upon the inclined plane and roll to the other end, ready to be taken again into the buckets



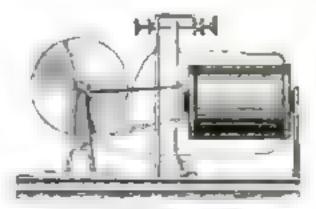


It Stopped When the Power House Did

A bold hoaz publicly uncovered in the most useful form of perpetual motion. This photograph shows the same kind of wheel on which the Marquis of Worcester, in 1648, wrote a learned book under the title, "An Advantageous Change of Centers."

This wheel was erected over a roadway in Los Angeles. It revolved slowly all day and all night, and the ostenable motive power was a series of metal apheres that run out quickly to the circumference on the straight side of the spokes and came back slowly on their curved side

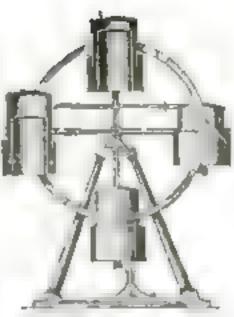
One day, when the electric power plant of the city shut down for a repair, the device stopped, for lack of motive power, and the mystery was solved



The Electric Mystifier

The frictional electrical machine is started, magnetizing the temporary magnet and drawing the armsture toward it. This breaks the circuit, demagnetizing the temporary magnet and allowing the spring to close the circuit again.

Says the inventor "If a magnet of a certain power will not move the electric plate, its power could be increased without decreasing the resistance which the magnet and conductor offer"



He Tried a Vacuum

Having perhaps perceived the futtiffty of manufacturing buoyancy under water and then trying to utilize it with a net gain this inventor tries the same scheme with air.

The cylinders, which have mercury packings to reduce friction are arranged by means of communicating valves to have a vacuum on one side of the wheel and air on the other-

The difference in weight be tween a vacuum and air is all this modest man wants to operate with, but be dreams of condensing the air to enhance the efficiency of the machine

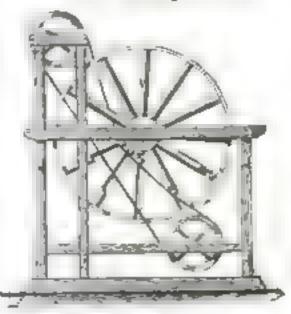
The Eccentric Weight

Here is the old eccentricweight idea. The wheel has twelve hollow spokes, in each of which is a rolling ball. The belt pames over two pulleys.

In order to allow the belt to pass freely and meet the balls, there is an opening around the wheel from bub to circumference

The balls are met by the belt as the wheel revolves, and are ratted from the circumference until they are at last brought close to the hub, where they remain until, by the revolution of the wheel, they roll out through the circumference.

Thus the balls are on one side of the wheel, always at the circumference, so that that side is heavier than the other, which causes the whoel continually to revolve





"To Roll Along . . . till Time Shall Be No More"

Here we show a railway carriage, self-moving, invented in 1829. The inventor had read everything about the shall be no more." The conocal wheels permit the fallocious machines already made, but his would carriage to accend a rising track without raising its "assuredly, if given a path encircling the earth, con-

time to roll along in one underlating course till time

tires and gears eventually wore out. A perpetual-motion machine is one that produces power by means of something that consumes power. It has been defined by a famous physicist as "a machine whose movement creates power to continue the movement." There is always crestion involved in the work it is supposed to do, and creation is not observed in any other machinery

Any work, be it ever so small, foots up, when continued for a long time. It can always be measured in footpounds. The power necessary for doing it can always be measured in footpounds to the second. One horsepower equals 550 foot-pounds a second, and

some security against perpetual-motion achemes would be established if those who support them would learn to insist on having at least 550 pounds raised one foot a second by the promising machine, and having this done for \$600 consecutive seconds without any help from outside sources. One horsepower for one hour is not too much to ask

of a person who claims to have an inexhaustible mine of free energy.

The veiled perpetual-motion schemes are the most insidious. In these the inventor deliberately employs a little real power to make the machine operate, but claims to obtain five, twenty, or one hundred times more power from it at the driven shaft.

Such a marhine is somewhat like s puppy wildly chasing its own tail. If it could ever catch it, the chase would In the bogus ma stop. chine, if the driven shaft, with its fictitious surplus of power, is geared back to the driving shaft, to take the place of the small but real power, everything atops. A very celebrated perpetual-motion engine was of a similar type. Professor Gamgee, of London,

obtained a United States patent on it in 1881, and made great commotion with his invention in industrial and ecientific circles. He used anhydrous ammonia, which boils at about 34° Centigrade, instead of water, in an engine similar to a steam-

engine. From a bollerful of hourd ammonia, which would develop a high pressure at ordinary temperatures, he figured on sending the vapors into compound cylinders to expand against platons. By the expansion the vapors would cool down to very low tension and in this state they would be exhausted into a receiver, further exposed to cooling, and thence led back to the boiler, whereafter the cycle of operations should begin again.

The Patent Office and the Navy Department approved of the plans, but it was not found possible to make any gain by first expanding the substance by evaporation and afterward condensing it sufficiently to get it back into the boiler against the pressure there existing, it being nature's

law that condensation generates as much heat and pressure as can be gained from expansion. Yet the scheme seemed plausible if the high-pressure boiler and the condenser could be kept at very different temperatures.

in many of the true perpetualmotion devices metal balls are depended upon to roll from one part of the mechanism to another and thereby produce motion of the machine parts against a resistance. If such a ball weighs 550 pounds and is made to carry a lever vertically downward for

chave an energy.

On achemes these the spiral five, mea more went shaft. that like a second.

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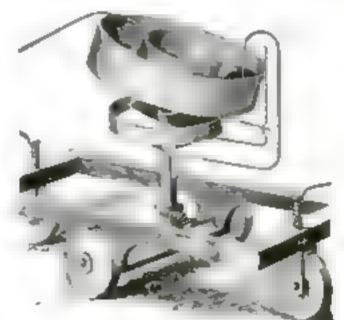
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A distance of second, it horsepower make it do for another sit back to came, and it the same amby the low therefore we the contrapt plicated.

Nearly all movements ized in the of them provided with the same and the same

It is clear that buoyancy is to make the machine run forever. Complicated chambers are provided for the entrance and cost of the floats to and from the tanks, but the underlying notion of buoyancy is foliacious and fatal. Buoyancy is not inherent lightness in the floats, but a lift action pure and simple



Listen to Dr. Dreach

This invention consists in the arrangement of an annular tilting tray, which forms the orbit for a revolving ball, to combination with a supporting platform, and with a lever which extends into the tray well connects with a shaft, to which motion is to be imported in such a reasoner that. by continually changing the position. of the truy, the ball is caused to retate therein without inherruption, and by the action ill the rotating hall on the lever, the little motion is imparted to the shaft in connection with the working machine or mechanism to be driven."

is it all perfectly clear now?

a distance of one foot and in one second, it will produce nearly one horsepower for one second, but to make it do the same thing over again for another second it is necessary to get it back to the height from which it came, and the raising will require just the same amount of work as was gained by the lowering. These devices are therefore very childrah. In recent years the contraptions are always more complicated.

Nearly all the known mechanical movements and expedients are utilized in the same machine, and each of them produces resistance and wastes power, whether it is a gear, a lever,

an incline, a magnetic clutch, a weight, or a float going up and down, a rocking beam, a pump, a water-wheel, or what not. They are all power-transmussion elements but not power

producers, and all operate with a loss.

But the more there are of them the easier the inventor can delude himself and others, until it comes to showing the machine working. The machine makes no argument. It simply refuses to work.

This is the one great characteristic feature which all perpetual-mo-

A number of them are illustrated herewith. Their best value lies in the mental exercise required for pointing out their fallacies in detail.

When defining what is understood by perpetual motion, it is necessary to exclude all plans for taking beat or motion or electric current from the forces that are active in nature or that may be generated from materials as long as these materials last. A clock, operated by the exceedingly weak current from a small quantity of adrum salt or from a dry electric pile, may be kept going for a very long time, as the power required is almost infinitesimal; but if the same sources of energy were to be used on a scale that could be

considered for power purposes, they would be found uneconomical and the materials would quickly be worn out.

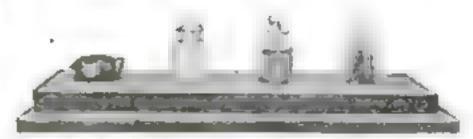
Among the natural forces that may be counted on indefinitely, changes of temperature from day to night and changes from barometric pressure have in several instances been employed for producing self-winding clocks and similar unimportant toylike contrivances. But these are not perpetual-motion machines, since the power operating them is well understood and is not used generally because it cannot be used conveniently on a large scale.

Saving Billions by Research

If it were not for research we might still be burning the old carbon-filament lamp



Since tungsten was discovered, in 1781 it was held to be anworkable. After much research, a method of working it was discovered. Now it can be drawn into fine heir like filaments. This woman is drawing tungsten rods through dismond dies to make lamp filaments.



In the picture above, from left to right, you see tungsten ore, the same ore crushed to powder, then unidized to pure tungsten, and finally in bar form, from which the fine wire is produced. Much experimenting was occusary before the tungsten could be made ductile





on confirm



The new services of a services

The Best Way to Do It

Major Frank Gilbreth, the noted efficiency engineer and motion-study expert, demonstrates the one best way



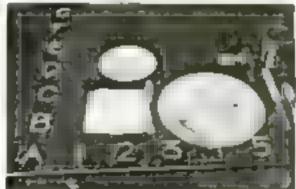
All the motions of changing the paper in a type water were charted and a no high out on the visualization board. One set if contains board. One set if contains the first too the tet represents the same or motions. By at my a these components any blind person can learn to work as rapidly as a good typic who has her eye eight to aid her

These times are the learning curves of three persons. They were told to write their names, omitting every other letter, and they did it twenty times before they approximated their customary speed

Mere Ma of Golden, hind at 1 is or one or or o, has result recent bearing to propose at lect are. by means of strings and thumb-tacks fixed at the groover in the board, the had man can follow the lecture art as people and they was again the back they are the was again to be a king of diagram.

These maps and pine represent the route taken in a certain office by documents, bills, etc. The carriers follow the lines laid out, that after many tests have been adjudged the shortest, and their output is materially increased.





A blind man's din oer-table ought to be charted and each utenall should be put in the same spot from meal to meal This will enable the blind man to find them without fumbling, as soon as he learns their positions



You can either stand or sit at your work if you use a Gibreth desk. Fictures of it appear at the left and the right. It reduces fatigue to stand occasionally, and your efficiency goes up if you reduce fatigues. Comfort is essential to good workmanship-particularly when one works at a desk all day. This desk and chair were built for comfort. Whether sitting or manding, the writer's terms are in the correct position. You will notice that the back of the chair slants for ward and that the foot-rest underneath the desk is curved.



Grading Rosin by Its Blush

An Apartment-House for Plants

ROSIN can be classified by its blush! Experts in the Depart ment of Agriculture, Washington, D.C., have developed a "comparison-box," which accurately compares the blush of a piece of rosin with that of a piece of colored glass. It is possible thus to grade rosin rapidly, without physical or chemical test.

Before rosin can be tested in the comparison-box, it must be cut into the proper sized cube. This is done with a small adze or hatchet. The cut rosin is then mounted in the comparison-box next to a piece of the colored glass. If its color is exactly the same as the glass, the grade of the rosin is known immediately. If the piece under test does not have the same color as the glass standard, the glass is changed until a piece is found corresponding with the rosin under test.

When the comparison-box is used, it is pointed skyward, and, to insure uniform light, a piece of translucent white paper or film is placed between the sample under test and the light.



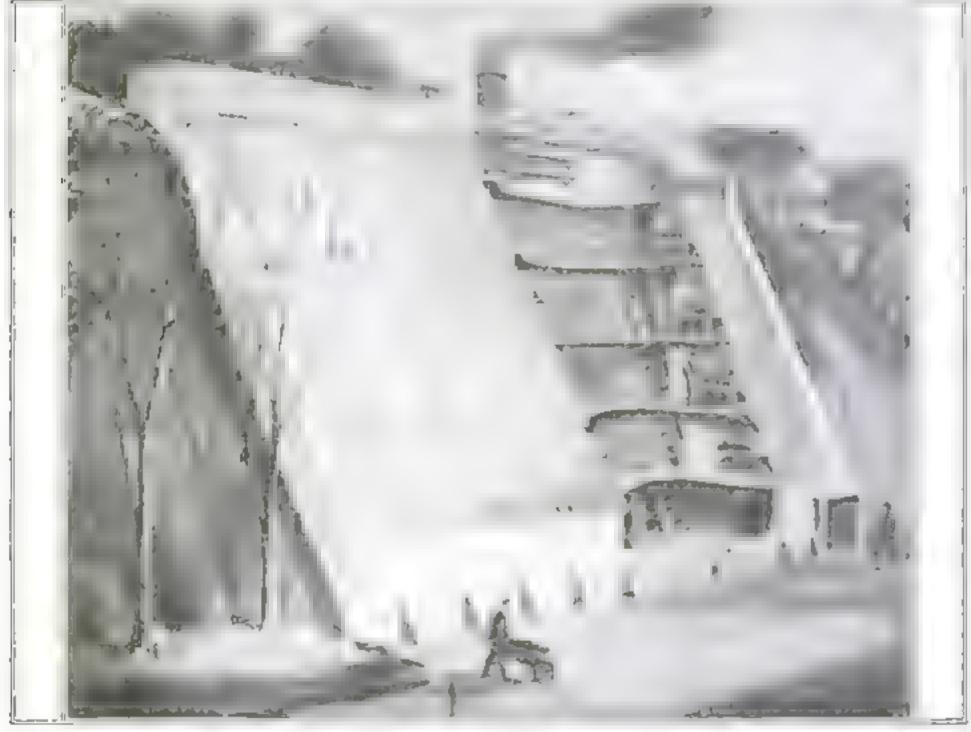
Testing rosin with the comparition box, obvicting a chemical analysis. Below in the comparison box, with a few samples of rosin to be tested, and the standard colored glass acreen with which the rosin is compared

PEOPLE live in apartment houses, so why shouldn't plants? So queried Walter Gouinlock, of Toronto. Whereupon he invented an apartment greenhouse.

The greenhouse is so made that it backs up against a bill, as shown in the illustration.

Any desired number of floors can be built, but they recede as they go higher up. In the basement there is a heating plant and a reservoir. Pure air from outside enters the basement through a pipe. It is heated, and then moistened by the water in the reservoir. It passes through an opening next to the glass wall, and heats the various apartments in turn, passing off through a ventilator in the roof.

The rear end of each apartment is against the hillside and therefore it is rather dark. Not wishing to waste best on these dark places, Mr Gouinlock provides a non-heat-conducting curtain that outs off the rear. The dark rooms may be used for growing mushrooms or for housing roots.



This greenhouse is really an apartment house for plants. There are several floors and they are all heated and moistened by one beating plant and reservoir in the cellar

He Made a Profession of His Hobby

William Richards has been building ship models all his life

BEING a Boston boy, William Richards was only eleven years old when he read "Treasure Island," and he was immediately filled with a great craving for adventure upon the high seas, and for battle with pirates over golden treasure. But being a Boston boy—he realised very

quickly that there were certain obstacles in the way that were apt to prove insurmountable, so he put aside for the time the craving for travel and adventure, and centered-his ambition upon a ship. He must have a ship. So he went to his father.

'Dad," he said, "I want a ship,"

"Then build one."
That was final, and it settled matters as far as the purchase of a natty, trim-rigged little ship was concerned. William Richards knew that the only way he would ever get a ship would be to build it, unless he wanted to waste the summer doing errands. So he got

out his tool-chest, sharpened the tools, and in the back yard there was great industry, with much sawing and hammering and smashing of fingers.

But the day came finally when he went to the pond in Boston Common and placed on the water an amazing collection of hits of board which he fondly called a ship. He gave the ship a push and watched it eagerly, when the ship wabbled uncertainly and then tipped up and went down by the stern. It had sailed for probably five seconds.

But young Richards was not discouraged. He fished up his vessel, went home, and set to work on another ship with the indomitable perseverance of a Sir Thomas Lapton.

Richards' second ship was more successful. It sailed proudly on the somewhat muddy waters of Boston Common pond—and one of America's greatest ship-modelers had started on his career

Every summer after that William Richards had a new fleet of ships, some of them amazingly original in design, but all of them seaworthy as far as the seas of Boston Common were concerned. He has been building little ships ever since, and his reputation has increased, so that now the

By Herbert Asbury

word of William Richards comes very near being the law as far as models of ships are concerned.

For many years Richards made ships merely as a hobby, but recently he went into it as a profession. He



As a boy, Wilham Richards saked his father for a ship, and was gently but firmly referred to his tool-chest

has an office and workshop down an alley behind a tenement-house in the Bronz, in New York city, and there he makes his ships.

He makes all kinds of ships, and his establishment is probably unique in the United States. There are, to be sure, other men who make ship models; but not only are there very few who make as fine models as those of Richards, but there is none, as far as he knows, who does exactly the same sort of work. He makes ships for the big shipbuilding companies, models made to scale that are used as silent salesmen. But the important part of his work, the part that he loves the most, is that which he is doing to interest the boys of the United States in the Morchant Marine and in the navy.

Every boy likes to build ships and things. Aimost any boy would rather have a vessel of his own construction, no matter how crastly it floats, than the best machine model that money can buy. But there are certain parts of the work that the average boy cannot do, and it is to overcome this trouble that Richards has devoted a great deal of his talent as a shipmodeler. A large part of his time now is devoted to the construction of

partly finished models, to be finished by boys who have a knack for that sort of thing. He makes them in various degrees of completeness, so that a boy of any age can find something in Richards' models that he can handle all the way to the finished craft.

Richards has worked for many years

developing his system of partly finished models. He has so developed his system that those who have never attempted to design or build techpically correct model yachta may, by using his drawings or the glued-up blocks aswed to shape inside and out, produce a correctly proportioned. accurately designed model which will sail and handle in the same manner as the large boats from which the model is designed.

It might be thought that these partly finished models are used entirely by boys, but this is not always the case. Richards is fond of tailing about the

New York stockbroker, a man of wealth and big business interests, who came to him one day and wanted a partly finished model.

He pointed to the six-foot hull of an unusually complicated ship model and said that would be about right for his twelve-year-old boy.

"A twelve-year-old boy never could finish that ship," said Richards. "You had better get him something simpler."

"Well," grinned the broker, "to tell the truth, I want it for myself."

Folk in ordinary walks of life may not know that Richards is one of the foremost builders of ship models in the United States, but it is known in private and governmental shipping circles. Besides his work for the big shipping companies, most of it tedious hand-work made accurately to scale, he has designed boats for a number of foreign governments, and during the war he was called to Washington as an expert model-maker by the Bureau of Construction and Repair of the Navy Department. He also made all of the half and interlocking models used by the Submarine Defense Association. He is a member of the New York Model Yacht Club, which holds regattas on the lake in Central Park every Sunday morning in the summer.

How Big Can They Build Them?

The problem of the large airplane and how it was overcome

TOW large can airplanes be built? Mathematicians once maintained that it was impossible to carry the size of an airplane beyond certain definite dimensions-dimensions dictated by theory. The men of figures argued that sisplanes had already reached their limit of size and carrying capacity. Why? Simply because the weights increase as the cubes of the similar dimensions, while the areas of the supporting surfaces increase only as the square. In other words, the ratio of weight to area increases as the linear dimensions until the point is reached where the machine will not fly

So dictates theory; but what has practice to say? Practice answers these mathematicians just as it anawered those who were kind enough to inform Langley that flying was impossible so that he would be saved a lot of unnecessary work! Langley kicked the theory of the mathematicians to death. The "law of the cube" has

also been outlawed.

The Mathematicians Were Wrong

During the war the desperate necessity of making larger airplanes developed. Aeronnutical engineers were instructed to design larger machines. regardless of the restrictions that were theoretically visible. Aeronautical engineering took a great step forward, and today glant machines wet their wings in the misty clouds. Theory was battered down, brushed saide, and forgotten. Today no practical limit is placed on the size of zirplanes.

How came the mathematicians to be in error? They forgot something. They forgot that the most sacred law of the cube held good only when a large airplane was a geometrical copy of a small one. When an airplane is so designed that it is not a copy of a small one, there appears to be no limit to the elze it may reach. When this was proved the law of the cube vanished in the wake of many other scientific

auperstitions.

New nerodynamical laws have been laid down that tell how large airplanes

may be built. Practice, not theory, molded these new laws into shape. They are very interesting, even to the layman. The first law states that with an increase in overall dimensions the weight must not increase faster than as the source of such dimengions. So far, so good. The second law is also a rold statement of fact. The subBu Carl Dienstbach

stance of it can be made known with these words: The larger elements of an airplane must be so designed as to secure, for a given wing area, the minimum of accordary structure.

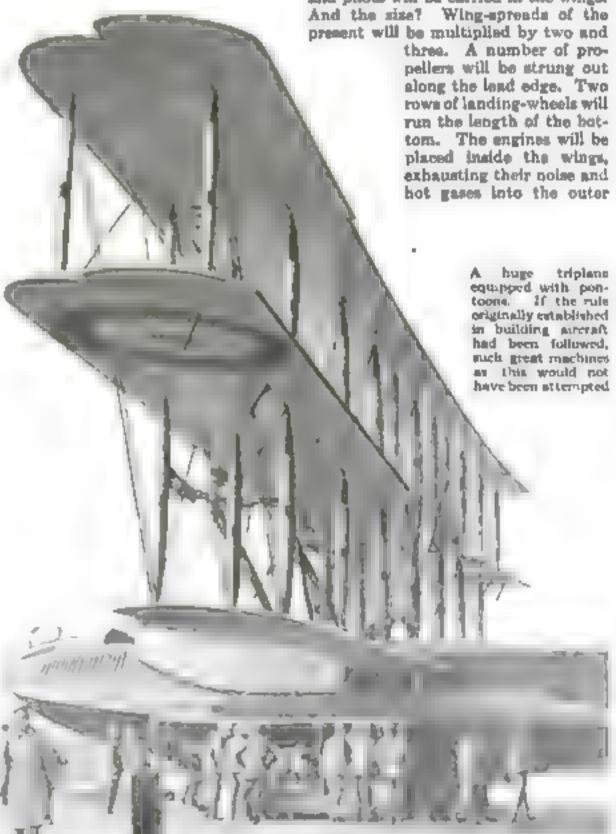
There is certainly nothing confusing about these deductions.

Fluing is Easy: But Landing!

At present, difficulties of operation make themselves felt long before the limit of size is reached. A flyingmachine can be made any size; but every flying-machine must also be a

landing muchine. This is where the aboe pinches. The landing problem is one thing that is helping to keep aeronautical engineering lashed to its present standards. Unfortunately, the larger an airplane, the more difficult it becomes to land. Large nirplanes also make necessary large landing-fields.

Aeronautical engineers today draam of great achievements in the future. They are encouraged by the fact that all the difficulties confronting them are practical in nature. No law, written or unwritten, puts a limit on the size of airplanes. Every engineer with imagination can see in his mind's eye the great mechanical birds of the future. It is quite possible that the passengers and pilots will be carried in the wings.



atmosphere. This simple description by no means taxes the imagination, nor does it stand outside the realm of the possible.

Everything is in favor of the large airplane. At first it was thought that the increased head resistance due to

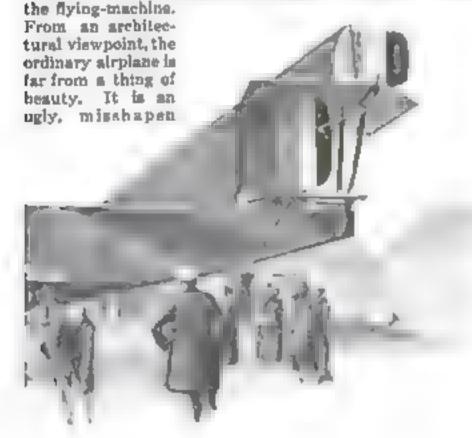
more elaborate "rigging" would be a serious obstacle to overcome. It was not nearly so serious gs was anticipated, for this reason: The size of the open "draggy" cockpits in the large machines became a relatively insignificout factor. The streamlining -the forms offering the least resistance to the nir of the larger machine is more perfect, and this more than compensates for the head resistance. With the large day bombers and Gothas came the enclosed cabin, with its luxurious fittings and perfect comfort. Of course. the huge airplanes used for bombing in the war were not provided with cabins, merely because the cabin did not meet fighting conditions.

Without enclosed cabins commercial aviation would always have been a dream.

Flying in Comfort

With it arrived a new era in flying. Today a man can step off the street in his Palm Beach suit, sit down in the comfortable seat of an airplane cabin, and go soaring aloft, feeling neither the intense cold of the upper regions not the terrific blasts of the passing air. The annoying roar of the engine is also reduced; all the comforts of the limpusine are possible.

The enclosed cabin greatly beautifies



thing. Its appearance makes the layman chary of trusting his life in it, but the cabin gives a sense of security.

The cabin adds a touch of symmetry. The first automobiles were not pleasant to look upon. The modern limousine is a thing of beauty. It bears a touch of



Large aurptance with several engines about greater safety than those with only one. When one esgine fails, the others can usually be depended upon

art. The airplane has not yet pamed a great distance along its path of evolution

As sirplanes grow larger they become less difficult to handle in the sir. This may be contrary to what most laymen believe, but it is nevertheless true. On the other hand, the larger machines are very difficult to land, and they also require large landing-fields. When in the air they almost fly themselves. The duty of the pilot has been reduced largely to a matter of finding the way and landing safely. Navigation in the air is just as important as navigation on the sea. The "aircaptain" is coming into his own. He

must be a thoroughly trained man.

One man wall by по means make up the "crew" of the large commercial a splanes of the There future. will be at least two pilots and one engineer. It in possible that machines will also carry a captain or navigator. It will be the duty of the engineer to see that the engines give unfailing servire, and to make capid repairs in

the event of one of them becoming disabled

The mention of engines brings up the question of safety. The passengers of the single-motored machine are entirely at the mercy of that one engine. It must not fail

Large airplanes must be driven by several engines, and if one fails it will result in nothing more serious than a reduction of speed. Thus, the safety factor of the big airplane is greatly in favor of its use.

Does the radius of action increase with the site of an airplane? This is a question that the layman is sure to ask. Many believe that it does. The truth is that it does not to any great extent. In this respect there will not be rnuch advantage in large fliers. Engineers have, so far, been satisfied to learn that the large machines reach about the same standard of general efficiency as the smaller ones. In the case of the dirigibles, the radius of action

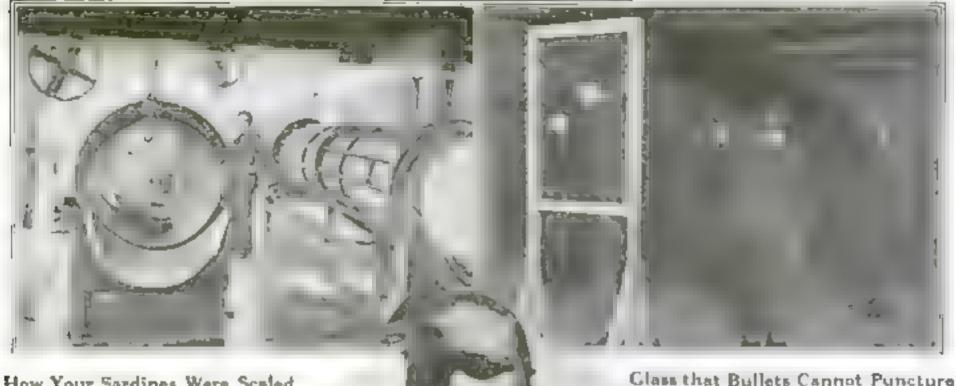
does increase with size because the efficiency increases. If the cargo of the large airplane is reduced in favor of a greater fuel supply, the radius of action will be increased

The history of the automobile tells us what to expect in the development The little -chup-chug of aviation. automobiles of fifteen years ago could not possibly struggle over the poor roads of that period. Were new roads built to accommodate the cars? Not at all. Manufacturers had to develop their cars to the point where they were able to travel over the bad roads. Then the good roads were built. Will the same hold true in aviation? Will manufacturers have to construct machines that will land with safety in any field or will a great belt of landingfields be placed at intervals all over the country? It is safe to prophesy that the development of the airplane will always krep ahead of the development of the good landing-places.

Sturding Ability Not Necessary

It is obvious that the larger airplanes cannot "stunt," like the smaller ones, Stunting, however, is not necessarily an attribute for a commercial machine. The military necessity for an airplane capable of maneuvering rapidly will always be met by the smaller types.

The larger machines must always fly on an "even keel," so to speak. Such stunts as tail-spinning and nose-diving would set up dangerous strains in a large machine and a disaster would probably be the result.



How Your Sardines Were Scaled

The acases have already been when you open to can be to Brabng done by hand? Not a v more. Observe the making has be Thown above.

The sardnes are place of cylinders, which revolve from right. to left. The continued rubbing of the amail fish against the perforated cyl nder case causes the scares to break off. A constant stream of water played on the fish carr or off the acales as soon as they are dethe heat

When the lish are thoroughly wacaled they are dropped into a the end of the purpose at



DORTLAND, Indiana, is trying out the portable hospital less for districts not sufficiently settled to make worth white a regular isolation hospital for contagious dipension.

The at your-door hospital is large enough to accommodate a standard size hospital bod, a table, a spall heating-atove, and one rocking-chair. Besides the door, five windows are provided, the rear one being placed in such a position above the bed that drafts do not strike the patient.

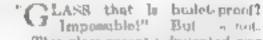


The Brass-Tube Queen

WHEN the chief of the Massi tribe taken unto himself a wife, he places around her neck yards and yards of brass tubing, which she must never remove. She also wears earrings made of steel colls that weigh more than a pound each. Any woman who can carry all that metal around with her deserves to be a queen

As a matter of fact, she is the only woman in the tribe who has any inde-

> pendence; the others are bought and sold for a few cows or spearheads.



Thus glass recently invented was put to a test in which steel inexcited indets of regulation caliber were discharged at it from ritten and revolvess.

The builds damaged the ginas, but they did not pass through it. Instead they were dashed loto fragments.

In the manufacture of the glass, sheets of plate-glass are thoroughly cusased and cemented together with sheets of cells loud between

These sheets are bound into a unit, producing a panel that retains the transparency of the best F 2 10 5

Dispossessing an Ark

BELOW appears a ship that was in Popular Science Monthly once before. That was in August, 1919, when Parson Lewis had just started to build it. He intended to sail in it to Liberia, the land of his birth, and to do missionary work.

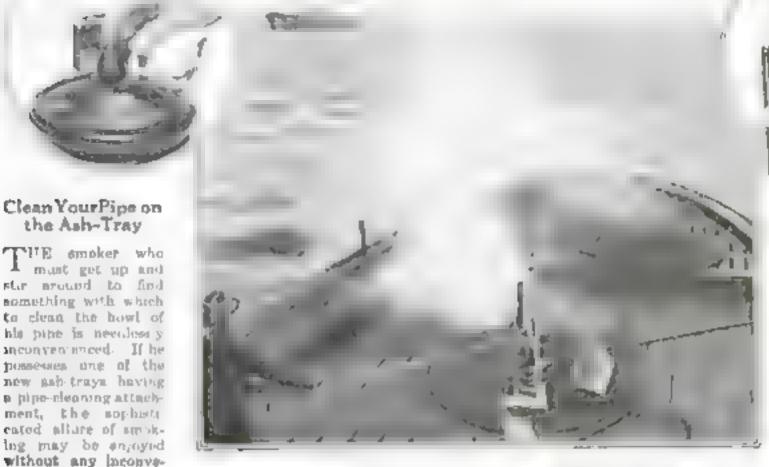
So far, he has built the hull of old lumber and has poured into it a layer of concrete.

Recently the owner of the land on which Mr. Lewis is building his ship, which might very appropriately be christened Faith, ordered him to move. He did not do so, and the sheriff appeared on the

But how can the sheriff remove the ship without injuring it?







A Cannon that Saves Instead of Destroying

nience. Without leaving his

the Ash-Tray

easy chair or even getting into an uncomfortable position, the smoker provided with the nah-tray shown above can thoroughly clean out the bowl of his

pipe

The pipe is inverted, placed over the prong rising from the center of the truy, and moved about slightly; the ask and residue immediately loosen and drop into the tray. The prong is also convenient for extinguishing eigarettes, since the burning and can be cut of simply by pressing it against the prong.

Shelf and Work-Bench in One

WORK-BENCH that will fold up and fit in a tool-chest; that when opened will form a sheaf for the tooks, and at the

same time afford a beach for working, is surely a serviceable ald to the carpenter. But that is not all this workbench will do. It can be used as a true or "wood horse" to support a platform on which the workman may stand!

To fold the bench it is necessary only to remove the plank that forms the top, and to turn the side plates vertically to permit the lower section of the legs to be folded back inside the upper bars of the bench legs. The leaves of the shelf are folded aver, and then the leg members are folded on top of the leaves. This makes such an arrangement so compact that the device may be readily placed in the tool-chest.

This device is a valuable adjunct to the curpenter's kit.

WHEN this cannon fires its shell in the weternal fight against the waves of the storm-tossed sea, it is to save lives, not to destroy them.

It is a new life-eaving cannon, baving a range of more than seventeen hundred feet, which is calculated to throw a line to a ship in distress.

in a test made in New York harbor, the eighteen-pound projectile, attached to a line coiled in a tube beside the gun, was fired from the deck of the John F. Hylan, a

police tug

The cannon is thirty inches long and has a weight of two hundred and ninety pounds. It does not recall, is quickly loaded and can be easily moved. On the first trial the earnum threw the line seventeen hundred feet.

When You Forget Your Ink-Dropper

HOW can the fountain-pen be f led without having a dropper handy? Amen does not usually carry a dropper with him. But in the crowd at hand there is lacty to be some one who bus a nelf ift ng fountainpon. If he can be inluced to lord it for a moment the trick is done.

Take the self-fishing pen and steep it in ink

until it is full. Assure the owner that no damage will be done to the point of his valuable self-filler, and permit him to watch the following performance.

Press the lever of the horrowed pen, and through its point discharge its contents of ink into the barrel of your own pen. Then refill the borrowed pen and return it.

There are many such instances so the above in our daily lives, requiring but a little ingenuity of thought to simplify a condition that otherwise would have to be tolerated in apite of inconvenience.

Potato-Gathering Made Easy

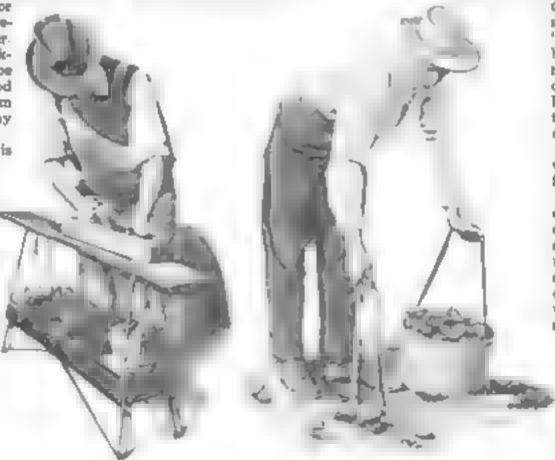
T will no longer be necessary for the potato-picker with row upon row of potatoes to gather to stoop over or kneel

> on the damp ground for hours at a time to bring forth the "spuds." Instead, he will have but to pass along each row, poking a grabber-like device at the potatoes which have been dug up. No petato can resist the clutches of these curious "tongs."

> The polato-picking device was invented by A bert Hossfeid, of Lewinton, Minnesota.

> The legs of the tongs are connected at one of their ends by a flat V-shaped epring rigidly secured by rivets. A flexible rubber strap connects the prengs of each pair on the inside, while a coil-spring holds the strap taut.

> > These tongs save the gatherer many an hour of back-breaking toil, especially if they are supplemented with the longhandled basket carried by the young man shown on the picture.





Wireless on the Boardwalk

MUSIC with your meals is an old story but

along the boardwalk is something else again. These

people are listening to a phonograph record being

This special type of wireless receiving outfit is the invention of Harold Warren, of Asbury, New Jersey. It is small, compact, and relatively inexpensive. It reproduces music audible mough to be heard above.

An ultra-sensitive receptor with a small loop antenna makes it possible to enjoy opera or jazz

played several miles away.

the noises of the boardwalk.

with the sea breezes. What next'

music received wirelessly while you are rolling

A Stereoscope Built for Two

HERE'S a stareoscope designed to accommodate two people at the same time. In the top of the upper compartment is a brilliant light-source diffused by a acreen of opal or ground gians. A partition through the lower compartment has an opening in which the glass positive, a stereoscopically photo-

graphed sl.de, is placed to be viewed from opposite sides. Between the slide and the eye less is an unsilvered sheet of plate-glass, which acts as a mirror by reflecting the diffused light of the upper ground glass, making it serve as a white background.

Black velvet beneath the mirrors provents reflection of light from below.

Let the Oven Mind the Toast

YOU don't have to watch your toust when you put it in the new electric tousting oven shown above. The oven will automatically take care of it for you. All you need to do is to place the slices of bread in receivers, press two levers downward, and turn on the juice. By pressing the levers you lower

the bread into the oven proper

There is a timing device at the front of the oven that can be set to suit your individual taste. Thus, when the bread is tensted to the proper brown, the current is automatically turned off and the toast is called out of the oven. Many electrical appliances seem actually to think.

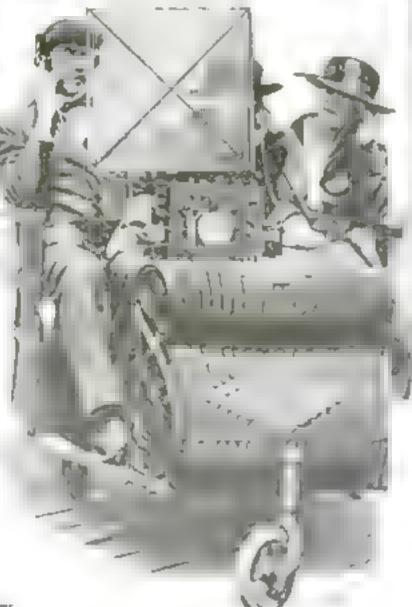


Do You Take Your Dog to the Dentist?

IF you love your dog, have his teeth examined requierly. A dog's teeth are just as apt to decay as human teeth. But he must suffer in silence, without even the comfort of heiding his paw against his aching jaw.

Dentists find that dogs are very apt to shat their mouths unexpectedly and smash at the instruments within A right clamp that can be strapped to the dog's head like the one shown herewith will do away with this difficulty

This clamp also assures your dog humane treatment.





This Rudder Makes the Boat Behave

This rudder gives perfect control over a boat. Two semicircular pieces are mounted up two shafts, one within the other. The pieces can be turned independently or together.

The normal position of the rudder parts is shown.

The boat's direction will depend upon which had of the rudder in moved if both the pieces are brought together at the same time, forming a cup at the back of the propeller, the boat will stop and then move in the opposite direction.



A Street-Sprinkler of Siam

IN Slam they don't have water-wagons of any kind at all. When the streets grow hot, a member of the street-cleaning department hangs a pair of watering-case on the ends of a wooden bar and places the bar across his shoulders. A handle on each can enables him to direct the flow of water.

The water-carrier himself is always cool. He walks through the water he has just aprinkled, and can aprinkle himself occasions ly if he should grow too warm at his task.



A Safety Catch for Your Tis-Pin

THERE'S hardly a man or woman who has not lost a te-pin or brooch at some time. And many of the lost pins were valuable

Why not put a safety catch on them? Mr. Harvey Basley, of New Jersey, has invented a simple catch. It is shown above.

The pin, instead of being straight, ends in a loop that fits enugly over a ballshaped projection. Even if the book should be pulled off the knob, its very shape would keep it from sliding out of the cloth

The whole pin would hang at the end of the book until rescued

This Pilgrim Risks His Life to Pray

Pil.GRIMS of the Taout order wishing to pray to "acquire merit" or "attain their heart's desire," visit one of the shrines on top of Hus-shan mountain. To do no they endanger their lives, for the ascent is very steep and the supports insecure.

The Chinese pilgrim below is shown standing on wabbly logs that are laid across posts driven into the face of the mountain. He balances himself by holding on to a chain. Below him is a sheer drop

of fitteen hundred feet. If he reaches the shrine in safety his wishes are supposed to be granted. Thousands of pilgrims than the mountain every



He Wears a Show-Case

WHY rent a store in order to sell candy? Here is a man who wears his candy show-case in front of him. It hangs from his shoulders by means of straps. The case is thirty-two inches long, sixteen inches wide, and fifteen inches deep. It is made of transparent collulated, but has a nine bottom; the whole case weight only six pounds. At the side there is a metal money-changer.

The salesman fills his show-case with taffy and walks through the theater district of Los Angeles at matines-time. One day he sold forty-seven dollars' worth of taffy.



New Light for the Photographer

"GOING to make flashlights?" they asked the photographer who had come to take a portrait in the dumly lighted room.

"No," answers the photographer. "I brought my electric ught."

From his coat pocket he takes a powerful little built, which, when backed up by a reflector, is strong enough to make short exposures with a fast lens.

Its light is rated at 450 walts. Its use will burnet that stared expression that flashight subjects usually wear.



MOIST tobacco is the only kind to smoke, that's why it is usually put in an airtight container

But there are other ways of sceping it moist.

Take, for example, the pouch shown herewith.

The flap is lined with material that absorbs water rapidly. When the flap is moistened and then closed down, the tobacco within will remain sufficiently damp.

In dry weather the flap needs to be moustened every other day.





a most to a unit Mest Lappet heets.

Also the rubber heel is upon to the criticiam that it slips on wet pevements. Water is to rubber what oil is to iron-a lubricant. Hence the many futile altempts to form the rubber bool with eo-called vacuum cups and similar indentations.

You talk like a man-why walk like a third?" asks Mr. John Van Heusen of Jamuica Plain, Massachusetta, He answers the question himself by inventing a rubber heel which makes a noise as it strikes the ground and which does not slip. In a word. he combines the residency of rubber with the sturdy noise of leather.

To attain his object Mr. Van Heusen sinks into the rubber heet, near its outer edge, a place of steel, which, when it strikes the ground, relieves the weater at once of the charge of "puncyfooting."

A Good Way to Secure Piling to Rock Bottom

IN the construction work at the Erie Basin and of the New York state barge canal at Buffalo, an interesting method of holding the bottom of a sheet-piling wall at rock elevation was used

instead of drilling a costly trench into the rock for anchoring the bottom of the piling, it was rested on top of the rock. Then three-inch steel bars seven feet long were placed in four-inch holes drilled four feet down into the rock directly in front of the piling.

The steel bars, bearing against the face of the piling for a distance of three feet, prevented it from being forced outward either by the pressure of the earth behind or by the load carried on the wharf

A Pencil that Lights Your Cigar

Tar. my pencil," anewers the man with n eger lighter attached to the end of his pencil

The top of this pencil puls out id discrete a wick and mutal point. When the metal point is

scratched in a groove at the side of the pencil, a spark is produced that lights the wick. When the top of the pencil is replaced, the flame is extinguished.

Inside the pencil there is a hollow chamber lined with absorbent material into which the cigar-lighter fits. The absorbent material is kept moist with herceens or some similar fuel. Thus the wick attached to the lighter is always saturated because of its close contact, and will flare up when a spark is created.

This little device will be a great friend to amakers. It will last a long time and will always be just where it is needed—held to the cost pocket by a clip, giving the amoker a twofold assurance of a light when he most needs one-which often happens when he is out on a tramp, miles away from houses and his fellow man.

Why Not Make Your Own House Models?

Here's a Phonographic Fire-Alarm

"FIRE! Call the fire department " But Central in allow to answer, on Wil-Lam J. Luce, of the New York Fire Department, invested this phonograph , resident

The explanation of this r wel invention sounds like the na rhyme a next 'the fre hurned the stick the etck bout the pig the pag ampel is rightest te-

The house containing thus phonograph fire-america wired. The sensitive ' heat" wires meet fuses, which furm an electric connection with a magnetic coil in the alarm-box. Heat so affects this that an iron weight is reseased, which starts the phonograph record.

For fifteen minutes thus record recites the location of the fire, the telephone receiver is lifted, and Central receives the message.



the cardboard house. "First we cut out the walls, straight up and down, and made openings for the doors and windows. We set up partitions between the rooms precisely as the architect had them in his Each story was plaza.

ON'T throw that cor-

away. Let us make the

new house from it," suggested the prospective

builder to the architect.

was the tiny model shown

in the illustration. This is how the experimenter ex-

planes the construction of

cardooard

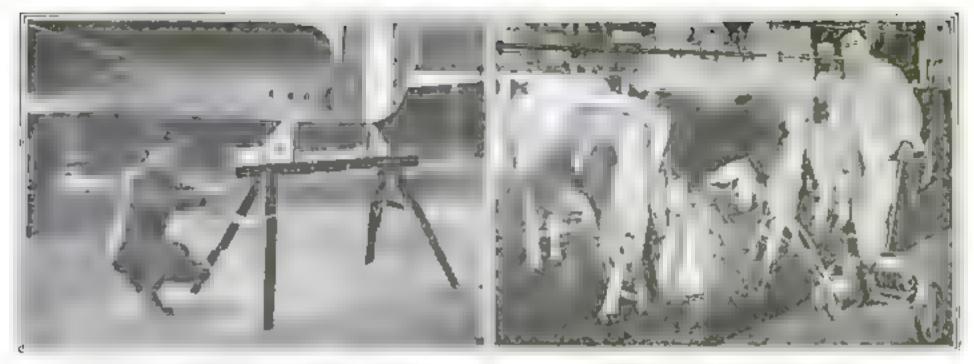
The result

augated

They did.

built separately, and tho roof went on last. The sections were then pieced to-

"The result helped us to visualize our prospective house, and to correct faults and omusions."



A New Screw-Bench for Airplane Work

A SCREW BENCH having a vertical and horizontal adjustment for the support of airplane bodies has been developed by aviation mechanics at Rockwell Field, San Diego, California. By means of the new bench it is possible to place the body of the machine in the best position for the installation of delicate mechanical work.

In repairing, overhauling, and balancing airplanes, it is often necessary to have the budy of the airplane in a very finely adjusted position. This is usually carried out with the aid of spiritlevels.

According to the old method of supporting the machine upon benches or blocks, the adjustment of position desired was often impossible.

With the screw-benches, however, the adjustment is altogether different. With the bench supporting the tail of the airplane, the position of the body may be moved horizontally or vertically the merest fraction of an inch. A micrometer is used for making the measurements.

Milking Cows by Electricity

THE cow will not kick over the milk-pail if she is milked electrically with the device shown above. Nor will she switch her tail in one's face. This automatic milker allows one man to milk as many cows as three men could by hand. It is also perfectly samplary. The test of the cow is squeezed by compressed air, and the milk is then sucked into the can through a rubber bose.

This little milker never gets tired, is always ready for work, and consumes very little current. The cons stand perfectly still while it is at work.

One man alone can milk fifteen cows in three-quarters of an hour with the aid of this new electric milker. And besides he is able to get more milk from the cows than he did when he miked by hand.

No pape-lines, belts, gages, or tanks need be installed in order to use the malker

Its value to the farmer of today, unable to find sufficient help, cannot be overrated. Of course most of the large wholesale dairymen are using some form of mechanical maker

Overalle Are Not for Airplanes

RUDDERS are meant to guide; not to wear overalls. The airplane rudder in the picture below caught a pair of overalls that blew out of the cockpit of its machine, became entangled in them, and sent the airplane into a disay spin. The pilot was unprepared for it, but he managed to right his airplane. Nost minute the machine took another spin. After many strange twists and turns, the airplane finally landed abruptly on the flying-field

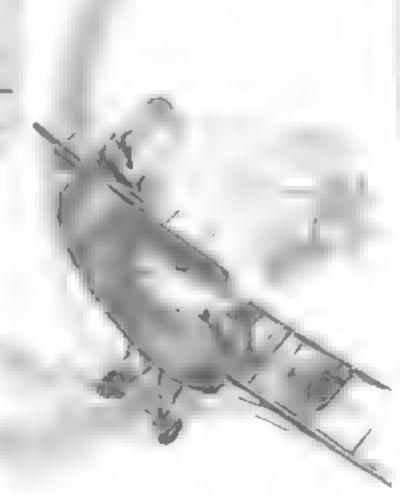
When the pilot looked over the machine to find out what was wrong, he discovered his overalls, torm to shreds, wound up in the rudder. This happened at Atlantic City, New Jersey



With Your Golf Pad On Your Wrist

WRIST-WATCHES are worn so generally that the new wrist golf-score pad will not annoy the golfer or interfere with his play. It furnishes him with a convenient place on which to keep his score

A small penril fits late a holder at the side of the pad. Each sheet is divided into two spaces, so that two players' scores can be recorded together. When one pad has been used up, the holder can be refilted. Players say that the pad does not interfere with a free wrist movement.





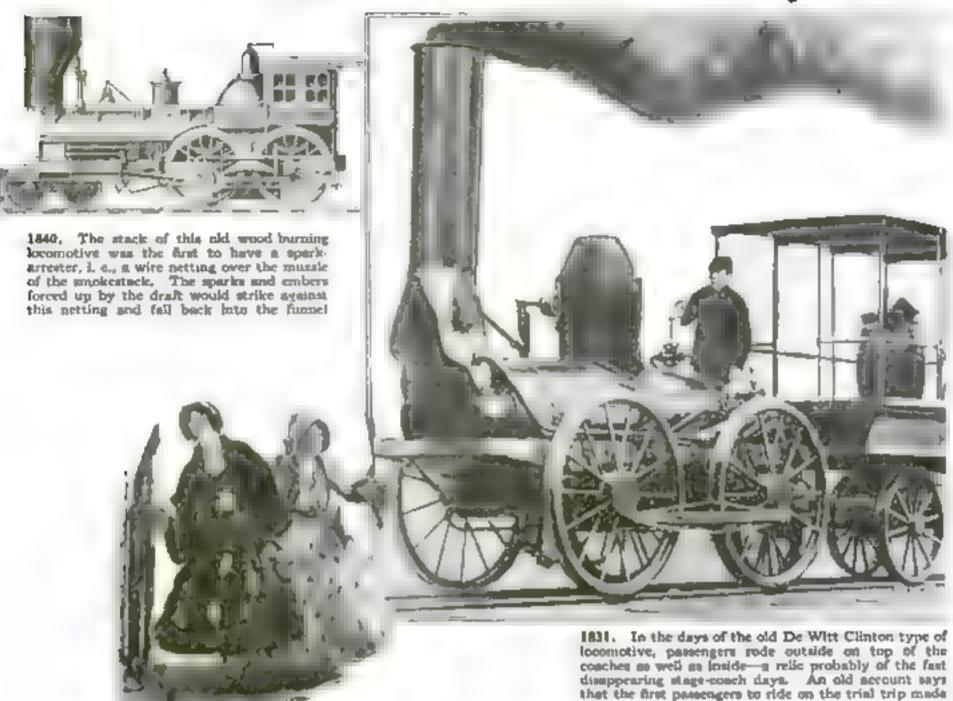
Brother to the Well Known Ouija-Board

PEOPLE are buying only-hourds faster than the manufacturers can turn them out.

A Los Angeles manufacturer has decided that he may as well get rich on spurits while they are in vogue, and so he is manufacturing a new board, enough the the caspo board to be its brother

On this new board a single finger may be used to guide the three-legged indicator, and thus several people can work the board at once. Just how they know which message belongs to which person, we cannot tell. That is something that only the inquirers know.

The Smokestack Grows Steadily Smaller

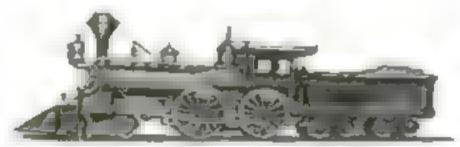




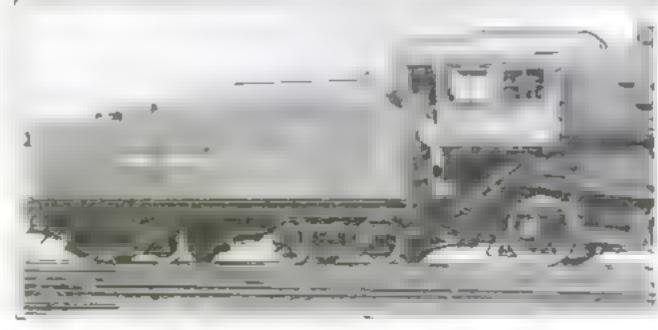
1860. The last word in wood burner emokestacks. Engines of this type figured largely in the operations of troops during the Civil War. Those were the days when

locomotives had personality and were given names instead of humbers. Hrass or copper bands around the smokestack or botter or even different colors painted upon their ades, was the order of the day

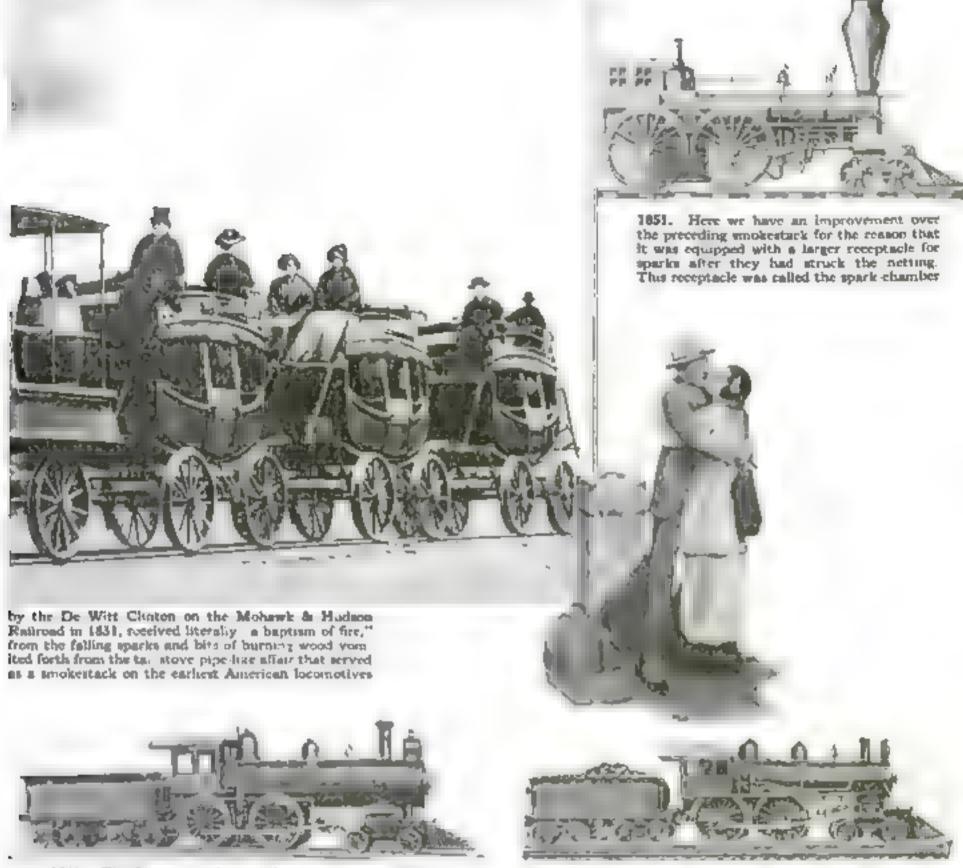
Arthrof this desire for individuality still exists in the practice of some Southern railroads in this country; and one may areasionally see a mighty, modern becomotive, pulling a heavy express train, with the name of the ungineer painted beneath the number on the cab, and with a braze or copper Masonic emblem, or star (according to the engineer's taste) upon the modernock



1874. The "bounet" anokestack. An inverted cone placed on top of the stack. Sparks striking against this deflected into the bounet, where the draft churned them until they were extinguished and pulverized sufficiently to pass through the netting



as the Size of the Engine Increases



1880. The first engine having the spurk-arrester in the muokebox in front of the boder. In this and later locomotives the smokebox was lengthened and extended beyond the point where the stack is placed, to accommodate the spack-arrester and spack-chamber in the among box.

1893 The plain amobestack—simply a straight pipe—tometimes flared a trifle—through which the draft carries off the exhaust strain and smoke. The amobestack diminishes, though the boiler still parries its quote of protuberances



1920. Save in the matter of their relative size, there have been practically no changes in the socomotive smokestack since 1891. However, as the size of the boiler has increased, so, step by step, the proportions of the smokestack have gradually decreased, until on the mighty locomotive of our own day the stack is not eighteen inches high.

The Mirage that Beckons Men to Death

Why do men see water and mountains when there are none?

DURING the fighting in Mesopotamia the British troops discovered one morning that they were shooting at phantoms. A news dispatch read: "The fighting had to be temporarily suspended, owing to a mirage; but upon this lifting our offensive continued." The same kind of witchcraft was be-

footing them that so often misled Napoleon's soldiers in Egypt, and that was first described in cold-blooded, scientific language by Monge, the French savant attached to Napoleon's expedition.

A party of American explorers not so long ago returned from a mirage-hunt in the Arctic. They went north to explore Crocker Land, which has figured on Arctic maps ever since Peary, in 1906, reported having seen from a mountain-peak in Grant Land "the faint white summits of a distant land" to the northwest. The recent expedition did not explore Crocker Land, because it wasn't there. What Peary saw was a mirage.

Three quarters of a century ago the American explorer Wilkes sailed along the Antarctic coast that now bears has name, and charted appearances of land at several points. A long-drawn-out tempest in a teapot has raged over these discoveries. Certain British geographers refused to believe that Wilkes saw land at all, and when the recent Mawson expedition sailed right over one of the spots where land is

over one of the spots where land is shown on Wilkes' chart, the case seemed to be proved. The same expedition, however, found that there is land, a whole continent of it, some scores of miles south of the latitude recorded by Wilkes. Probably he actually saw this continent at several points, but underestimated its distance on account of mirage.

The Mirages of Hot Cities

It is not necessary to travel either to the polar regions or to torrid deserts to see specimens of this interesting phenomenon. Some very fair examples of mirage may be observed, on still, hot days, over the asphalt of city pavements in our own latitudes—ranging all the way from a mere tremulous appearance of distant objects, to the apparent pool of rippling water that has deluded so many travelers in the desert. A recent writer in the London Times says:



The reflecting surface of sir is below the level of the observer a eye. He thus sees the image inverted

I witnessed this afternoon a remarkable example of the mirage on the north side of Grusvenur Square. The whole surface of the roadway appeared a sheet of water. My first impression, before I realized what the phenomenon was, was that a water-main had burst and flooded the road. On approaching closer, the water broke up into pools, and then disappeared altogether. The disturbance of the heated layer of air by the motor-care exactly reproduced the effect of wheels spleaking through shallow water. I have frequently seen mirage in the desert of the Sudan, but I have never observed a more realistic sakibition.

Marine mirages are familiar to most dwellers by the shores of oceans and lakes. Describing mirages over lower New York bay, a resident of Sea Gate writes.

It is a very common occurrence to see the east shore of Sandy Hook and the constline beyond (the Seabright shore) raised above the horizon, and occasionally this mirage will carry the sky clear under the Navesink Highlands. On a still, hot afternoon some large houses, towers, and characters on the shore of Staten Island will be raused in the air by a mirage, which occasionally is very beautiful and very suggestive of the descriptions of the desert mirages.

Passing vessels are often curiously distorted and enlarged, and this observer has sometimes seen vessels reflected in two perfect images, the lower reversed and the upper right side up.

On one occasion he saw the lunnels of a passing American liner apparently hundreds of feet tall, while the masts were lengthened out to wavy rods of incredible size.

Most Common at Extremes

Mirage is most common in hot deserts and in the polar regions, because such places most frequently furnish the abrupt contrasts in atmospharic density upon which the phenomenou depends. When air is warmed, it expands: when it is cooled, it contracts. In calm weather the hot level surface of a desert rarefles the air just above it. Most school books will tell you that the laver of thin air reflects objects above exactly as they are reflected by a sheet of water-the process known to physicists as "total reflection." Although this is not strictly true as a scientific statement, the not result is the same. The layer of rarefied air does act as a mirror, and an observer looking down upon it from a higher level seen a reflection of



In this picture the reflecting surface of air is above the eye level. Looking through the denser layer, the observer sees the mountain projected in the sky and apparently closer



The "Looming" Mirage that Deceives Explorers

The kind of mirage known as "looming" is one of the most exteresting. There is no inverted image, but low shores may be reflected so the sky as high cliffs, and mountains and objects far below the horizon may appear in the sky and magnified. Scott and his party made use of this phenomenon in the Anteretic regions for detecting objects beyoud the normal reach of vision. The picture shows a landscape with palm trees and mountains as seen when lifted up and magnified by looming.

This is the kind of mirage that may have given rice to Peary's "Crocker Land"



Greenware to Proceed at well as beautiful effects are often presented in a mirage. Distant cities may be seen reflected in the ast. Above is depicted the famous Fata Morgana.

the sky, which produces the effect of an expanse of water. The unsteadiness of the heated air gives an appearance of ripples, and the effect is made still more realistic if trees or other terrestrial objects are reflected along with the sky. The common mirage of the desert is known as inferior marage.

Distant Objects Heightened

The form of marage most common in the polar regions is known as fooming. This has the effect of increasing the apparent height of distant objects; and it may lift into view objects that, in a normal state of the atmosphere, are hidden by the curvature of the earth or by intervening hids. Wilkes probably saw the "loom" of the Antarctic continent, while Peary was misled by the looming of ice-fields and icebergs. This lifting of remote objects also produces, by a natural association of ideas, an illusory effect of nearness.

Another phenomenon frequently met with in high latitudes in superior marage. In this form of marage inverted images of ships, ice-bergs, or other objects are seen apparently suspended in the sky.

Both looming and superior mirage are due to conditions exactly the reverse of those that produce the inferior mirage of the desert. A cold sheet of water or ice is overlain by a layer of abnormally dense air. Looming is the result of the refraction (bending) of rays coming from objects above the dense layer; superior mirage, to the reflection of objects within it. Both processes may be roughly reproduced by the following experiment, in which water, which is a transparent medium much denser than air, repreduced

sents the dense lower air that produces mirage.

Fill a glass about half full of water. Hold it somewhat above the level of your eye and close to a wall covered with figured wall-paper (any vertical surface with distinct marks, letters, or the like, will do as well). In a certain position, the surface of the water, seen diagonally from below, serves as a mirror, reflecting the wall-paper with its pattern reversed. With your eye considerably lower, you will be able to glimpes the pattern through the water surface, erect but apparently lifted much above its true position. The former case is analogous to superior mirage; the latter, to looming.

Sometimes air layers of different

density are side by side, and then we get lateral murage. This may often he seen by looking close along the side of a brick or stone wall on a hot day. More than two horizontal layers may produce multiple images. Lastly, a mixture of nevers. masses of air of different densities results in combinations of the different kinds of mirage, and we see objects variously distorted. Some remarkable cases of this kind are shown in the classic drawings of William Scoresby, the Arctic explorer. He tells us that along the shores of Greenland "the general telescopic appearance of the coast was that of an extensive ancient city, abounding with the rules of castles, obelisks, churches, and monuments, with other large and conspicuotta huildings—a grand and interesting phantasmagona. "

Origin of the Fata Morgana

The Fata Morgana—a weirdly distorted view of the Sicilian shore an seen from Regglo—is also due to a combination of different forms of marage.

If there seemed to be a chain of mountain peaks looming quite near with their lofty summits clearly outlined against the sky, the observer rising in a halloon or an airplane would soon see them vanish, dwindling into the nothingness of a haze. Far in the distance he might detect with the aid of powerful glasses, a chain of real leebergs, or remote mountains. The part of their summits which protruded above the denser layer of air would be seen reflected inverted as in a mirror on the ground. They would then appear as distant mountains reflected in a body of water.



What seem to be deep pools of rippling water in the sandy valleys between desert mountains. Caravans wading through these reflections find no substance in them

Compressed Air Takes the Place of Muscle

HE man who moves a tool back and forth across a surface of steel or wood, giving to the surface a suitable finishing touch, can now perform this work three times as fast by employing compressed air, which is controlled to furnish the moving power of the tool, and at the end of a day's work his muscles will not ache as they ached when he did the work entirely with his own energy.

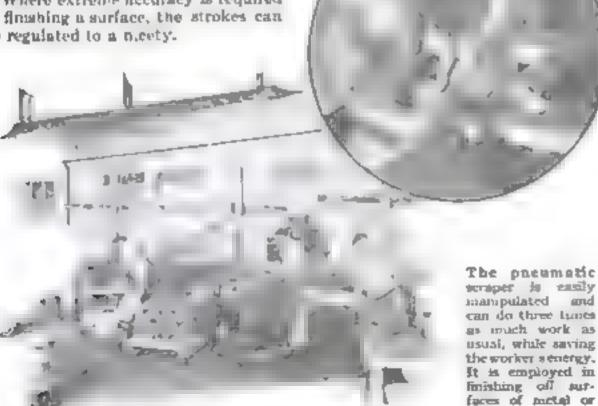
An advantage of the mechanical "scraper" is its adaptability to strokes of various length. With the right hand the operator grasps the valve that controls the power, and by automatic management he is able to impart either a long stroke or quick, short strokes. The movement can be halted in an instant. A slight movement of the workman's right hand produces the forward stroke; slightly releasing his hold on the valve causes the tool to return, ready for the next stroke.

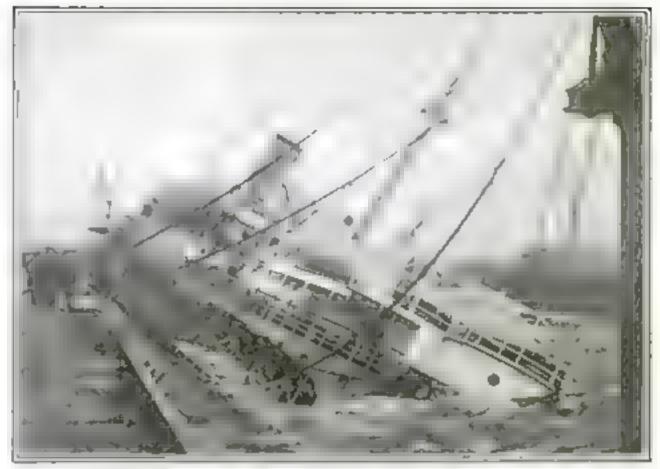
Scarcely less important is the support of the tool. Either a stationary or a movable support can be used, the latter having casters or small rollers which make it easy to move. A bracket carries the beam which enables the apparatus to be rismped around the upright support, or to be raised and lowered. Four rollers carry the scraper along the under side of the beam, while a "universal" joint permits it to be turned in any direction.

Mr. Swan F. Anderson, of Rockford, Illinois, is the inventor of this labor-saving device.

It is adaptable to any tool that moves in a backward or forward direction, and is valuable when employed by polishers and burnishers, or by the workmen who would save their energy finishing a surface of steel.

Where extreme accuracy is required in finishing a surface, the strokes can be regulated to a nicety.





When the Moodanin, which sink at her New York wharf, was raised, she had a pronounced list. This was corrected in an unusual manner

Seeking Gravity's Aid to Right a Ship

ENERALLY speaking, ships that I sink in the depths of the sea are "down and out" forever. But ships that go to the bottom in depths of two hundred feet are now being successfully raised, and many ambitious schemes are being promoted for raising ships from depths that are even greater.

The Moccoun sank alongside her wharf in New York. The sinking was from "unknown causes"—perhaps it was from the opening of an ashes port or sea valve. In salving her, all compartments, hatches, and deck openinge were first sealed by divers. Suction lines from powerful pumps were then rigged up, and all the water was pumped out of the ship until it was entirely replaced by air. This caused the ship to come to the surface. But when the Mocrasia was brought to the surface she had acquired a pronounced list to starboard.

This list was corrected by a novel operation. The ship was loaded with more cargo in the shape of broken rock. The rock was all loaded on to the port side, the side highest out of water. Gravity did the rest and brought her to an even keel.

Milk and Meat as Rivals

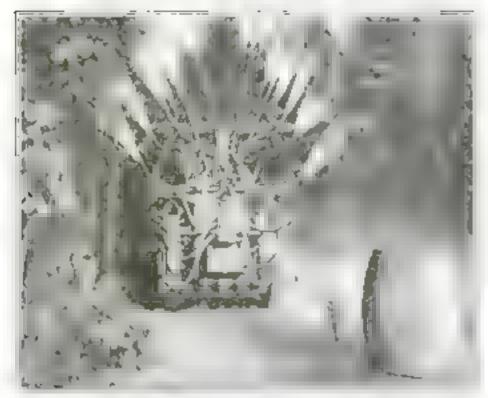
S the price of ment sours upward, many people are forced to be part-time vegetarians. Thus the old question, "Is meat essential to human well-being" arises again. The Commutee on Food and Nutrition of the National Research Council has issued an Interesting report on the relative value of meat and milk.

Eighteen per cent of the protein and energy of grain used in feeding a cow goes into the milk, and is therefore recovered for human consumption; whereas only three and a half per cent is recovered in beef. As for the mineral elements in hay and grain, not much is stored in the tissues, but a great amount goes into milk

Beef profiteer, beware! The hardpressed public may decide to let milk take the place of beefsteak.

wood

A Multiple Spraying-Machine



An Englishman invented this spraying machine, which looks like a strange animal. It sprays trees of various heights at once

THE apraying-machine has not escaped the searching mind of the inventor, and now the multiple apraying outfit has come into use.

This machine is the invention of an Englishman. It is provided with no fewer than twenty-four nonzies. These are arranged at various heights, so that trees of different age can be treated. In the picture above only the higher nonzies are in use. A pump forces the fluid out of the many nonzies at considerable pressure. In this way, a large orchard of trees can be treated in a very short time.

The multiple apraying-machine is a formidable device in the battle the farmer is always waging on insects.

Finding the Dust with a Mirror

A CONVEY mirror of the kind mounted on an automobile to show what is coming from the rear, can be satisfactorily employed to see how much dust has

accumulated on the inade of lighting fixtures. When the mirror is secured to the end of a pole, it can be held up over the rim of the inverted bowl that screens the eye from the direct light. The purpose of a convex mirror instead of a plane mirror is to get a wider field of view.

Factories and stores, or offices where a great number of lights are used, suffer a sovere handreap when dust settles over the issue of the inverted fixtures. In some instances nearly fifty per cent of the light can be lost without noticing the change that has progressed so gradually with the gradual accumulation of dust.



An extension pole can be used to support a convex mirror, making it easy to detect any accuration of dust on alevated fixtures

And the housewife, too, will find this contrivance of value, since more and more indirect lighting is being adopted in private homes. A san afterthought, she might use this invention in hunting for articles on shelves.

Telephoning Over a Ray of Light

A SYSTEM of sound transmission by reflected rays of light has recently been developed by Professor A.O. Rankins. But it cannot be used for distances of more than fifty miles, because of the curvature of the earth.

The transmitter consists of a disphragm similar to a phonograph

nound-box, a small mirror mounted on the end of the disphragm, a projecting lens, and another mirror. The operator talks into a trumpet that brings the sounds to the disphragm, causing the lever and mirror to vibrate almost imparceptibly.

By means of the focusing lens, a strong light is directed against the mirror, passing through a shutter with parallel slits to split up the light. This is reflected from the nurror into the second lens, in front of which there is also a shutter with parallel slits. Since the little mirror vibrates in accordance with the sounds directed against the dis-

phragm, the reflected rays from the first lens to the second will not always register exactly with the slits in front of the second lens. The extent of this discrepancy determines the intensity of the beam of light projected from the secondary lens, in exact relation to the character of the sound

The wound of the voice is the trumpet causes a mirror to vibrate and, aided by strong light rays, the voice is reproduced

received by the special transmitter.

At the receiving end there is another lens to gather in the beam of light, focusing it on a selenium cell in the circuit with a telephone receiver and an electric battery. Now, selenium changes its electrical conductivity when subjected to varying illumina-

tion, and hence the electric current is varied with the transmitted rays of light, the receiver reproducing the sounds just as it does in the ordinary telephone system.

The lack of strict privacy in wireless telephony is one obstacle to its complete commercial succes. Mossages sent become the property of any amateur who possesses a receiving equipment. Thus while the range of wireless is unlimited, its privacy, except where code n used, is impossible. In other words, no one can corner and bottle up wireless for commercial exploitation and control. Hence the great value of Professor Rankine's invention.

Making a Loop in New York's Subway System

And thereby putting an end to a nuisance

VISITORS to New York—and not only visitors, but natives who have suffered confusion in attetching their necks following the black (or the green) line at the Times Square and Grand Central subway stations, will welcome a plan that has been devised to do away with the present complicated arrangement of the New York subway transfer system.

Connections between the East Side and West Side subways can at present be made only by means of the shuttle train that runs through Forty-second street.

Two Plans Are Offered

There are two suggestions that can be followed in relieving the congestion. The first is the better. The sum of \$4,000,000 is estimated to be the amount required to put it into practice. The Thirty-fourth street Board of Trade puts this plan forward, designating it as the "Independent Loop," It makes use of existing structures and tracks wherever possible.

The southerly track of the old subway from Broadway through Fortysecond street, which is now unused, would be the starting-point of the new system. This track is connected with

Bu Lawrence Whiting

a track in the Fourth avenue subway, and is unused as far south as Thirtyeighth street. It is proposed to extend this track down Fourth avenue to Thirtieth street.

In Thirtieth street a one-track subway would be constructed to connect the Fourth avenue with the Seventh avenue line. On Seventh avenue, from Thirtieth street to Forty-second street, a new track would have to be laid alongside of the present northbound local track. The present arrangement of the Pennsylvania subway station makes some changes necessary at this point. North of the mation the track would run under the sidewalk, turning into Forty-second street to connect with the southerly track and passing under the Heidelberg building. A new platform would also be required.

Two stations would be constructed in Thirtieth street between Fourth and Seventh avenues, one located near Fifth avenue and the other probably near the Broadway crowing. There would be two stations in Forty-second street, one at Bryant park and the other convenient both to Fifth avenue and to the Grand Central station

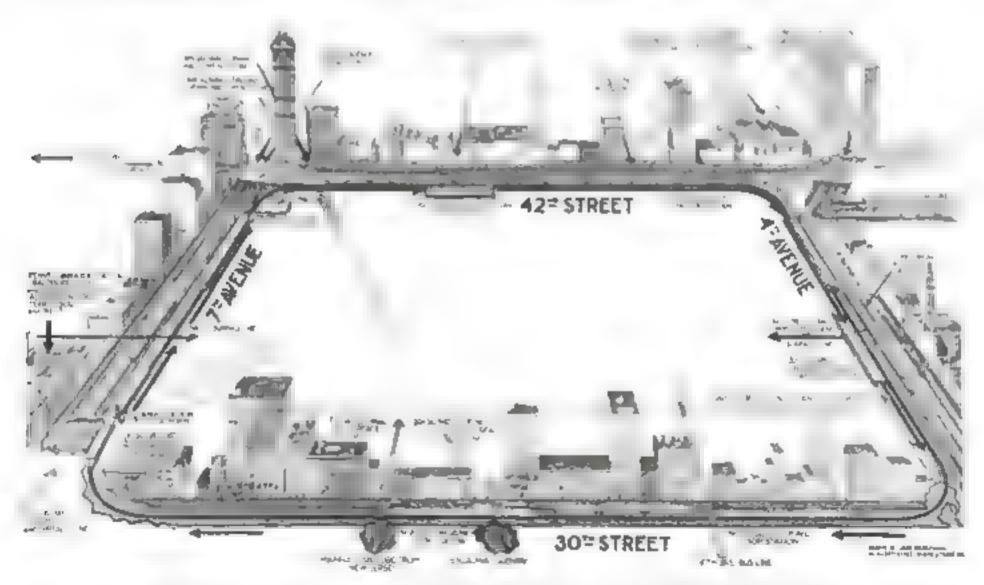
The alternative plan, which is estimated to cost about \$2,000,000,

makes use of the present tracks of both subways, with the construction of a new single track through Thirtieth street. The schedule of the downtown local trains in Fourth avenue and the uptown locals in Seventh avenue would have to be slightly rearranged to accommodate the increased use of these tracks.

Connecting Two Great Terminals

Trains would be operated by running them south on the Fourth avenue local line, then west through the new Thirtieth street subway, and north on the Seventh avenue local tracks to Forty-second street, then east to Fourth avenue, following the present line of travel. The number of loop trains would be limited by the local southbound and northbound traffic.

One can see the advantage of either of these plans. It provides a direct connection by subway between the Grand Central station and the Pennsylvania terminal. Within these districts are the leading hotels, retail stores, and passenger railroad terminals. The plan would also provide an easy means of transfer between the two subway systems of the East and West side.



New York's proposed subways loop, providing more transfer platforms. The chief feature is the use of the present subways with the construction of but a single track and the extension of one other

Sneak-Thieves in Overalls

Disguised as honest dockmen, they pilfer from the very ships that give them work



This three doesn't specialize in any particular line of pelf He takes anything that happens to be lying around loose, and conceals his ill gotten gains in a money belt.

Men don't usually wear cornets particularly the overalled class but this fellow, after stealing them, wears them home under his overails





Tap too top H is now y to the top with a top to the top with the forbidden aquor

This man wraps drap eries about he is, but he doesn't use discretized to be a hear of a control of a control for the station for the fashion



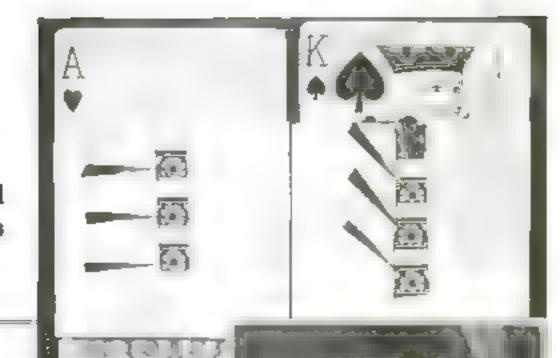
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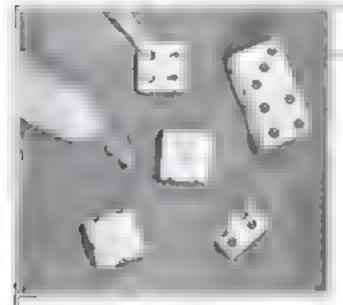
Procedure as the short of the state of the short of the pilerer across at some acrost spot where he may unload

Beware of These Age-Old Tricks of Crooked Gamblers

Marked cards, loaded dice, and other devices of the unscrupulous

Laurency of Ven Universal Science Magazine





Study the design of the deck that the professional gambler holds! Note the alightly varying widths of the design If the first space is of the greatest width, that eard is an acc. If the accord space is the wide one, it is a hing if the third space is queen while the fourth space pruclauss a jack

Fred Kenting, master magician, holds a hand from which he can pick the aces. One way of identifying them is by slightly "crimping" their corners

Here are leaded dice. Shots of lead placed in the right position made the "leater" always adjust the falling dice so the lucky "neven" will turn up, after they roll out of the box



Here is the "shell game" exposed! Of course the praise not inder the cover of the cover because the praise of the cover because the praise of the cover because many people.

An unused sipe is an effectual and when it has a unail from a ter beat. The ir age of whatever eard he saids as that of to his partice and the said ter decides wout to play

A lightly possibled signetping is a conservate opparent. The gambles is a the ring so that a excitor card is reflected theart has matter than a wing what card theart was the game





You Can Recharge Your Own Flash-Lamps

MOST poeket lamps have

An English company has pure agreed a wet battery land the larma stendy for ter

West to a connecting the with up picetra circuit

The plates are on a practice of the plates are only and a positive pole there is a security which in an accessed to a sulphurit acid. When the bat-

tory needs recharging, the poles are connected with a three-ampere circuit and seft for several hours.

Paper Kept Under the Counter

IN most stores wrapping-paper rolls are placed in stands that block up much of the counter space. And every time the elerk wishes to wrap up a package, he must reach for the paper. But now there is a new paper-cutter and sholder that

Bin under the counter and is invisible except for the cutting-edge

It is entirely out of the way when not in use, yet it is right there when the clerk wishes to use it. He pulls at the thin edge of paper that appears beyond the binde and then team it off when he has had enough. The picture below shows a man using one of these paper-holders and -cutters, and how space is saved.

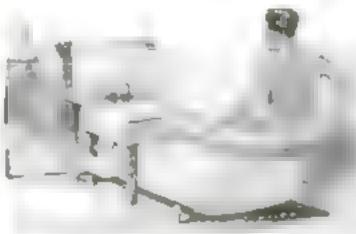




A Chinese Water-Clock

BEFORE the Occidental clock found its way to China, a cumbersome water-clock was used. It consisted of four buckets placed on four steps and connected by chutes. The top can was filled with water

From can to can the water trickled until it reached the bottom can. A ruler protrusied from an opening in the lid of this bottom can, and the ruler rose as the water rose. There were time marks on this ruler and thus the Chinese told the hour



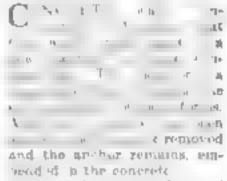
The Bench Legs Fold Up Inside

A BATH I'B seat, a seat attached to the foot of the bed, or a shelf attached to the wall—this is the invention of hir George S. Stuart, of Washington, D C. It is composed of a wooden box open at the hottom and arranged to accommodate the folding legs when not in use.

How do you open it? By placing a hand in the slots and swinging the seat up to a horizontal position, then the spring will swing the legs to a vertical position and a cord will prevent them from being awarg outward too far. A clamp acrew permits the legs to be adjusted to the proper length required for a bed, a tub, or a shelf



Anchoring Bricks to the Side of a House



When the outside layer of bricks is applied, S-shaped hooks made of spring-steel wireage fastened ander the edge of the anchor which has been priedup. These bind the bricks

Thu anchor is also used to fasten tile walnesting in place. In that case the wire forms a mesh.

Heating with an Electric Fan

DON'T know when you will get your coal? That needn't worry you, for an electric beating-fan has been invented. The heater may be attached to any electric-light socket. When the current is turned.

on, coils within the heater grow red hot, and a small fan sends the heat out into the room.

All the heating and blowing mechtaneous are carefully enclosed in a non-heating case. Thus, when the fas is sending out blasts of hot air, you can put your hand on the case without burning it at al. In summer the fan part of the device may be used for cooling the air. This is made possible by two switchess.





He's Catching Frogs for Dinner

WHEN you consider the fact that the Chinese est sharks' fins, sea-slugs, ducks' tangues, door's sinews, and pickled fir-tree cones, it is not at all surprising that they eat from too. They do not stop at frogs' logs; they ant nearly all of each frog And they sat 'em boiled, fried, broiled, mineed.

How do they catch their frogs? By means of note similar to the one shown Bbove.

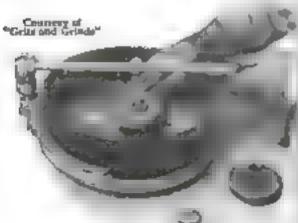
The free-catcher stands at the edge of the water with his not in his hand. When his victim hope on a stone within reach, he swoops down, catches the frog in the

meshes of a large net, and then takes him off, placing him in a backet.

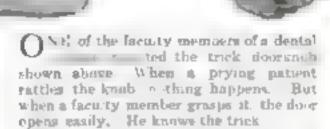
Grinding Lenses by Machine

DID you ever wonder how lenses were made? First, the molten gisse is cast into shape. Such pieces are called "blanks."

The blank is fitted to an Iron block with pitch or wax. It is then placed in the rapidly revolving bowl, and held by a steel penuli that fits into a hole in the center, making the blank revolve by friction. The surface of the bowl is kept covered with a mixture of fine shrasive powder and water. As the blank revolves, these abrasive particles take bites out of the glass surface. This operation is repeated. until the surface is thoroughly polished.



A Doorknob with a Secret Combination



The knob and its stem are separate sections. The first and second fingers are placed around the stem, as shown in the lastration. By pressing the stem and knob together, they are brought into con-

tum and the latch act-

How Deep Is This Crevasse?

N the state of Washington there are ten large national parks. Chelan Park is one of them, and it is a favorite place for tourists. The Lyman Glacier is located in the park, and many visitors climb it every year. There are deep mysterious crevasses in the glacier, caused, most likely, by bregularities in the bed of the glacier, also its variable movement.

The picture below shows some daring tourists getting as near as they can to the crevame without falling in. One of them has even spanned it. The glacier itself is a mile and a half square and moves very slowly. The surface rises gradually and walking on it is comparatively safe.



Their Queues Are Made of String

THE Wakamba brave wears a pirtail. Just like the Chinaman? No; the Chinaman's quoue is of real bair, whereas the black man's is made of string. His hair is short and fussy, and he ties the string to it. To cover up the connection, he wears a funnel.

Why does he go to all that trouble in order to have a string hang down his back? Just because it's the custom. Perhaps if the Wakamba native saw a picture of you wearing a stiff white collar, he would wonder why you were trying to choke y ourself

> Incidentally the Wakamba women wear steel stockings and armiets, and are sold for a few cows.

It Grows with Your Business

A DESK littered with letters, memorands, and other data is most unsightly. Keep them, rather, in an expanding desk-file like the one shown below. Each compartment is a separate unit. You can add as many units as your need dictates. If you index each compartment and keep the proper items in it, you wil. avoid confusion and the possible loss of valuable data, to say pothing of the time caved in being able to inmediately locate them.

The pecemary bolts and rubber supports go with each unit. Thus you can add to your file from time to time as you need new space.





of plans glass mossited in a frame so that it will stand vertically.

By looking through the gessa on the beank paper, the picture to be copied will appear, and all you have to do is tract the reflection.

A Concrete "Log" Cabin

OG cablus are very nice for the summer. - but when old Jack Front puts in his appearance, the comfortable modern home with its conveniences is the place to live.

A man living in Yankton, South Dakota, I ked log cabins so much that he built his home to resemble one. He used concrete "logs." They were all of a size, since they were all cast in the same muld. The logs were made with interlocking ands so that they fitted together just like real logs. The foundation of the house is made with prairie rocks.

Swayed by Summer Breezes

"HIS granite pillar shivers in the wind. The slightest breeze rocks it gently to and fro. The great column is almost perfeetly balanced on its pedestal. So purfeetly that it is sensitive to the smallest atmospheric disturbances. The shaft is over one hundred feet high with a diameter of but twelve feet at the base. When rocking, it moves from two to three feet at the ager. The base reats in a small bollow about three feet deep.

It is almost a certainty that erodon will cause the shaft to fall some day, but just how seen, no one known. When it does fall, there will be a great crash in the neighborhood of Garden Park, Canon City, Colorado, where it is located.



VERYTHING in the world but its use -even shell fungue. Its bard, white ner es can bo

Any charp-pointed testrament was out late the mut-

When next you go to the country, etch some scores on this furgus, or try your band at portraiture- if your friends raise no objection

If they turn out well, give there away as Christman or birthday

A New York artist, Mr A. Zipprich, has made fungus etching his hobby, and he has done some very delicate work.

Sampling the Soil

F you are out in the country and see a man get out of a buggy, the his horse, and take a long auger with which be drills a hole in the durt bank at the side of the road, do not be hasty in passing judgment and think him a lunatic.

This man is probably an export sent out by the Bureau of Solls of the Department

of Agriculture

With the auger he drills into the ground and collects a aample of the sell below the surface. This material is bottled, inbeled, and analyzed.





ANY people to lowed Hornes are elsy's advice and went West to grow up with the country. The West is inresty populated with people who were once Easterners. Every year these eastern Westerners hold state picales, where they go to meet the people from their own home state and town. In this way many happy friendships are kept abys.

John Jones, who is now married and has noven children, meets Sadia Smith, from Peoria, Illinois, who used to be his sweetheart. Sadie and John worked in a cannery years ago and it is enjoyable to get together to talk old times over

Sadle and John met again by signing their names and addresses to lists that were posted on the trees in the grove where the picnic was held. When people arrive at the grove, they read the posted lists to see if any of their old acquaintances are present in this way, the picnic is really a huge get-together.

Carry Your Rubber Heels with You

YOU start out in the morning and the sun is shining; you come back at night in the rain—feet dripping wet. Yet you can't very well carry subbers with you every time you go out.

Now, however, there is a new heel-rubber that you can put in your pocket. When it rains you take out a pair, slip them on your hoels, and proceed -secure in the knowledge that at least part of your shoes will remain dry. In winter, when there's ice on the ground, these detachable heel-rubbees will keep you from slipping, according to the inventor

They would make also a good substitute for rubber heels, with the suded advantage of making you independent of the cobbler around the corner

A TOMOBILES are made for poor why not strplanes? The R brothers of Italy have developed a mach what could be seid at a reasonable price.

The little triplane is said to be the smallest flying-machine ever built. Its span is only eleven and a had feet. A forty-horsepower engine gives it a speed of seventy miles an hour, which it can continue for four hours—or from New York to Boston without stopping. With a length of twelve and a half feet and a height of seven and a half feet, it is possible to keep this machine in a garage.

This airplane, although small, is an allround machine. It outs up the gas, makes a lot of noise, and can be used for "etunting"

In some respects It is more efficient than larger machines. It can leave the ground at a speed of twenty-five miles an hour. It weighs three hundred and thirty pounds and is capable of lifting that much weight.



Reducing the Glare of Electric Light

CONCENTRATION of light in a small area, such as in the electric are and filament, produces a brightness which greatly harms the eye.

It does slowly what a few minutes of direct gazing at the sun would accomplish. We realize now that direct rays from an unshielded illumination are bad for the eye, hence this ray-diffusing device with as little loss of illuminating power as possible. The new eye-shield device effectively achieves this result.

A Hand-Loom for the Convalescent

THE next time you are taken ill with a cold or the measles, weave belts in bed to pass the idle hours away.

This little hand-loom is extremely simple to manipulate, and attractive designs can be produced on it.

It can be constructed in a few minutes with a few tools, and the results obtainable are surprising in every way. Hand-bags, trimmings, and hatbands can also be made by its use.

The little patient in bed, in the picture below, is weaving a belt on a hand-loom that her daddy made for her





Pencils with Their Own Night-Lights

WRITING in the dark is evidently often practised, for two self-luminous pencils have recently been invented.

One comes from England. It has a battery, a light hulb, and a glass case that fits over the pencil to protect the bulb.

The American invention, patented by Philip S. McLean, is simpler. It provides for a shield lined with self-luminous material. The shield, adjusted by, a spring, may be attached to any pencil.



Making House-Wrecking Easy

HOUSE-WRECKERS recently saw a new tool tested, which is designed not only to save time, but also to prevent the lumber from being split prying it apart.

The invention is that of a carpenter, William Henry Rich, of Wrentham, Massachusetts. It consists of a hande twenty-six inches long, one end of which terminates in a wedge-shaped part. The opposite end has a claw and a metal connecting bur

When a board is to be pried from the support to which it is nailed, the head of the tool is placed under it. The leverage of prying is increased, and the pressure is distributed by the balance this "double-pronged" head affords.



Raise Your Cap and Comb

CHARMED," you say as you take off your cap in deference to the newly introduced. But, also, your hair is all mussed up and you are a sorry right. To remedy this, Alva Dawson, of Jacksenvilla, Florida, recommends the "combined head-covering and hair-comb" that he has invented

It is a cap with a comb in the peak and a small stud for moving the comb back and forth. When you raise the cap, you push the stud backward, and the comb plows through your hair Of course, to get the best results, you ought to wear your hair pompadour atyle.

A Centralized Rivet-Heater

INSTEAD of having to start the forge fire, carry coke, and heat the rivets superately here is a device by which a number of rivets can be brought to a working heat at once

Oil furnishes the fuel, and the rivets are placed in a compartment in which they are all bested together, and delivered, ready for the workman, instead of having the workman walt for them. From the furnace to the works the rivets can be conveyed by small motor-truck or serials in from two to five minutes. They will retain their heat one and a half hours.

Shipbuilders, boiler-makers, and builders of steel structures will all benefit by the invention.



This Spoon Acts as a Straw

YOU don't need a straw with this drink, or that res-cream sods. The handle of the apoon, being hollow, serves as a straw. Eat the les-cream or the crushed fruit with the apoon, then draw up the delicious liquid through the hollow handle.

The spoon is made entirely of glass, and at the back of the bowl there is a small opening through which the liquid is drawn.

Be careful, though, to prevent the small tube from becoming clogged.

Reading Can Be Enjoyed When Wearing This Headlight

OFTEN you may wish to make notes with pencil and paper, or to read when suitable illumination is not at hand. Then the "head-lamp," invented by Charles S. Burton, of Oak Park, Illinois, becomes serviceable.

It consists of a bulb and socket connected with a battery which can be carried in the pocket; ashade to protect the eyes from the rays of light; and a reflector to throw the rays downward upon the book or paper held in a position for reading. The reflector and eye-shade are draigned to be folded together to protect the lamp when not in use.

Run Your Own Side-Wheeler

THE side-wheeler, though obsolete an a steemboat, is quite new as a hand-propelled straft. A satisfying speed can be made in this best and it can be managed with little trouble, hence the new invention is very popular

A crack in each side turns the wheel by a simple arm movement, and the boat can be sent on a forward, backward, or a turning course at will

Walter Johnson, of London, England, in the inventor. The boat is known as the "paddle-boat," and it provides all kinds of sport on pond, lake, or stream.

In England the side-wheeler has become a keen rival of the punt and the rowboat, owing to its speed and ease of manipulation.



To Hitch Horses Humanely

ONG from rails have been installed dalong the wharves at San Francisco for hitching the big truck-horses

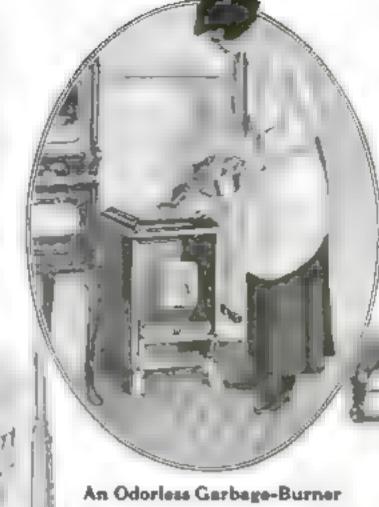
left standing by teamsters.

The traces are fastened to a long stout bar, and the borse stands as if hitched to a wagon. The reins from the bit are also tied to the bar. Thus probably leads the horse to believe that It is merely waiting to be driven.

The use of the bltching-post, or n weight, keeps n horse's bead in a more or less confined and cramped position, and is less humage than this

The horse is such a universally beloved animal, that thu de-

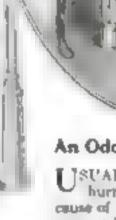
vice will be welcomed.



SUALLY one does not like to hurn garbage near the house because of its disagreeable odor. Now comus a home gurbage-burner, which is placed beside the gas-range

It is gas-burning, and has a draft to carry away all the unpleasant

fismes



Freeze Milk and Find the Water

SPECIAL apparatos has been constructed by Dr Hortvet, at the laboratory of the Minnesota State Dairy and Food Commission, by which the amount of water contained in a sample of muk is determined by the milk's freezing-point.

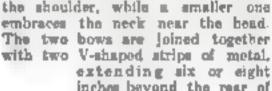
The unadulterated milk of a bealthy sow freezes at thirty-one degrees Fahrenhelt. The ther-

more that well contains a scale of each degree so greatly magnified that minute fractions of an inch can be read with a The point at which the

A Fettered Watermelon

"H1S watermelon got mixed up with an old bicycle wheel when it was young, and it grew up fettered with the wires. Although its shape was affected, its size was normal and its flavor was not impaired

"Warmed by the sun and wet by the dew," the watermelon grew, despite the resisting wires. One of the spokes can be seen on the point of breaking.



Correcting a Cow's Bad Habit

STRANGELY freakish as it may

own milk, thus depriving the farmer of the valuable product. J. Luther

Emerson, of Frankfort, Kentucky, has patented a "cow-weaper" that breaks

The weaper has a stiff collar that

fits tightly round the cow's neck and is

so arranged as to prevent the animal

from reaching around. One large bow encircles the portion of her neck near

this habit

seem, some beiters feed upon their

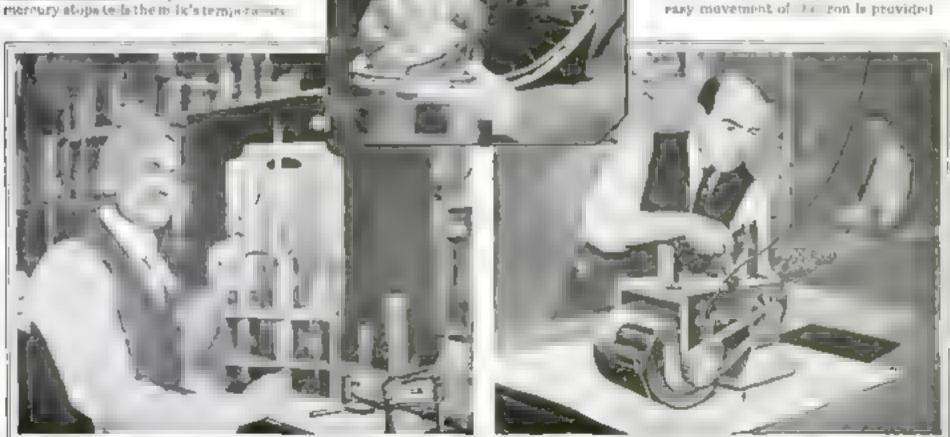
inches beyond the rear of the bow



T took Abraham Max Holtzman, of Brooklyn, New York. to discover from experience that a new style of fron would be a rolle! to the premer, so be invented one.

With the ordinary light Iron, all the pressure that counts is the strength of the man who moves the iron. The new sadiron consixts of a roller, braied by resist-

ance code, and a flat section, also beated An electric switch manipulates the motor that moves the heavy from over the rioth. In this way pressure as well as



New Jobs

for the Old Wax Figure

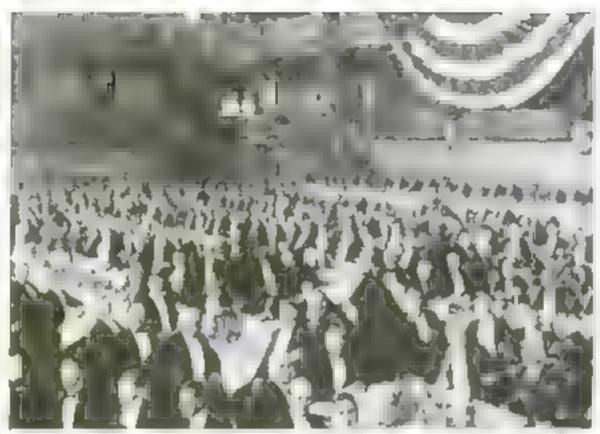
GONE is the lay figure with the far-away stare and the painted black hair that glutened like patent leather. Gone, too, the illfitting suit of hand-medowns, marked "Take me home for \$10," that the

In its place is a lifelike wax figure displaying its expensive clothes with aristocratic caretessness and epitomizing what Broadway considers "class" in beauty

figure used to wear











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Keeping Up with the March of Science

Facts for the man who wants to know

Cold-Storage Fish

COLD-STORAGE eggs have been found to be paratable. Now we are presented with cold-storage fish. Those who have already eaten some easy that it tastes just the same as fresh fish, and chemists say that the food constituents of the fish do not seem to be affected by the months of freezing.

If the fish are frozen promptly when they are caught, they will remain the same for at least a year.

Many Shoes Made from One

WHEN a Mexican automobile refuses to wear an old shoe any longer, the shoe is sold for a few cents to a poor native, whereupon he and his family wear if

rie cuts the shoe into thick sines which very according to the size of the family's feet, thus out of one shoe he makes many. They retain their natural shape and are bound around the feet with though. In relay weather non-akid above are worn by some of the more presperous natures.

Davy Jones' Rich Cargo

A DIVER was sent down recently at New York to locate a case of machinery that had falien into the river. As soon as he reached the bottom he signaled that he wished to come up.

When his belinet was removed, the first thing he said was, "What's the number of the case?" There were so many cases at the bottom of the siver that he didn't know which one belonged to his employers. The amount of cargo that is lost is leading and unleading ships is enormous.

Use Your Weather Man

THE American Meteurological Society has formed a Committee on Corporation Membership to bring before professional and business men the reasons why they should become patrons of the society

The more funds the American Meteorological Society has, the better it will be able to carry out its sime, superially in fostering meteorological instruction and research. Are not the possibilities of being able, for example, to make seatonal forecasts, or to predict the path and speed of a West Indian hurricans, or to know beforehand where and how much snow will fall in a winter storm, worth the expenditure of considerable sums of money?

A Three-Handed Watch

NEW YORK state has two kinds of time -raifened time and daylight-saving time. There is an hour's difference be tween the two, and travelers find it hard to remember which is which.

Mr. E. A. Bernard, a watchmaker of Little Falls, New York, would solve the problem by riveting a second hour-hand to the original one so that they are spaced exactly one hour apart. He would paint the new hand red, label it, and thus eliminate confusion.

Turkish or Greek Tobacco?

OST of the tobacco for which Turkish eigerettes are famous is really Grecian tobacco, grown in Grecian Macedonia or in other parts of New Greece, namely Lavalla, Xanthy, and Yaka, as well as Thessaly and other parts of old Greece

The little real Turkish tobacco in use comes from Samsun, Trebiaond, and the const of the Black Sea. About eighty per cent of the tobacco in so-called Turkish eigerettes is Macedonian or Grecian, and only about twenty per cent Samsun.

This doesn't mean that eigerette-makers lie about their tobacco, but simply that Turkey has been losing her personations to other countries, and among them important tobacco-growing areas

Evidently tobacco does not follow the flag. Since a rose by may other name would smell as award, "Turkish" digaraties sold as "Greek" ought to have just as fine an aroms. If we must think of tobacco geographically, then let us call it by its right name.

Safety of Acetylene Gas

IN the oxygentylene-welding flame the combustion of the gas (acetylene) is thorough and complete by reason of the flow of pure oxygen used in burning it. Even if this were not the case, the welder might inhale a mixture of acetylene and air without encountering any injurious furnes.

George Gilbert Pond, Ph. D., professor of chemistry at the Pennsylvania State College, in his excellent bulletis on calcium carbide and acetylene, resource his readers with the remark that acetylene gas is "so free from deleterious quality that leaving a jet open in a living-room for a week involves no peril to human life."

The "deadly fumer" strong in brass welding, where these have not been prevented from escaping by the use of proper fluxes or welding-risks are due to apporating of the size contained in the brass. Brass is approximately sixty per cent copper and forty per cent size. When heated to a point of fusion, unless proper precautions are taken, a part of the sine will escape in the form of white smoky fumes, the chemical term for which is "zine oxide." Brass will give off these fumes at a fusing temperature, if an effective preventive, such as the proper flux, is not employed, no matter what the source of the melting heat.

Oxyacetylene is generally used in the fusing and welding of metals because of its convensence, economy, and its remarkable property of localizing a sufficient intensity of beat within the range of the work to which it is directly applied.

Renewing Old Automobiles

THE more expensive automobiles are characterized by a fineness of work-manship that their owners little appreciate. Parts sometimes fit together with an error of only a ten thousandth of an inch. The result is wonderful smoothness of running. But when the parts wear away they must be accapped—at least, that has been the practice in the past.

Major B. M. Thomas, of the British Institution of Automobile Engineers, now calls attention to a method of neving much of the money that acrapping entails by a new method of building up the worn parts by electro-deposition. A worn part is plated with a layer of metal that is not only hard, but that needs no heat treatment. A little grinding, and the part is ready to be installed. The plating forms an integral mass with a part on which it is deposited so that it cannot be separated. The plating can even be case-hardened; it penetrates into the metal beneath

Owners of motor-truck freets, whose repair bill for new parts must run into the thousands during the year, will now be able to save meney

Mosquitoes Dislike Swamps

RECENT experiments prove that, contrary to the general benef, mosquitoes do not thrive and multiply in foul, stagaant water. In fact, mosquito larvar actually lose vigor and die when surrounded by decomposed vegetation

Whether this is due to bacterial action on the larvas or to an excess of injurious gas due to the decomposition, has not been ascertained. At any rate, swamps are not guilty of encouraging masquitoes, and clearing these swamps does harm.

Wood from Dead Trees

WOOD that is cut from sound dead trees—is it as good as wood cut from live ones? Many buyers are prejudiced against dead wood, but there seems to be no reason for it. The Forest Products Laboratory may that there is no way of distinguishing the dead from the live after the trees are sawed into sumber

Of course, dead trees that have been allowed to stand too long are apt to become decayed or infested by wood-boring insects. But trees that have been dead only a short time yield strong, lasting lumber.

The Steel Slug that Exploded

ONE day an employee of an electrical manufacturing company whose job it was to superintend the hardening of slugs of Sanderson carbon steel "used as plungers in making genelite, a new self-lubricating metal —drew a slug out of the electric furnace, quenched it in a tank, and then

beld it in his left hand. As he was about to test the hardness of the sing with a rasp, his attention was distracted

At that moment the end of his rasp tapped the flat end of the slug . It flew to preces with the crack of a pistol. One piecesaried pant his ear, another flew straight up, and the remaining two dropped back in the tank.

What is the explanation? Probably the sing, which was about four and one half inches long and four inches in diameter, cooled a degree too quickly on the outside, so that the best-expanded core exerted a curface tension so unusual that the sightest touch at the exact moment produced a violent fracture. There was evidence of core strain in the fragments. This is a unique acrident

New Uses for Damaged Fruit

WHEN such stuff as garbage can be made ever into useful products. why made over into useful products, why can't damaged oranges and lemons be put to good use?

There are already several by-products of the prange and lemon, but the California fruit-growers are looking for more.

Cular-no the dumaged fruits are calledare rich in mil and citric acid. They should he worth nearly as much as their more healthy brothers

A research laboratory has been established at Corona, California, to find new uses for cuille.

Hath Music Charms?

Do all animals like music? The best way to find out is to go to a zee with a muncian and stage a recital. Recently a violinist played for the animals in the Landon zoo and the effect of his music on the various animals was very interesting as an experiment.

Snakes, lizards, and scorpions were the most appreciative sums of them waggied and swayed; others crept up close to the vious and listened, exchanted. sheep, wild hogs, bisons, and sebras were all mildly interested. But the wolves, foxes, and elephants fairly snorted with rage

The monkeys were divided in their sentiments: some nodded engerly, and listened. others seewied, and turned away dugustedly

The Menace of Dope

HOW many drug addicts are there in the United States? Estimates vary from 200,000 to 400,000. According to the committee on the narcotic drug situntion in the United States, all estimates are to be distrusted. Thus in July, 19.9. there were 6741 registered drug addicts in the greater city of New York-many fewer than the actual number

But, however incorrect the estimates may be, they become a arming when they

are analyzed.

Thus twenty-three per cent of \$500 registered addicts in New York city proved to be chauffeurs, motormen, and drivers. That throws a ray of light on the real menace of narcotic drugs.

What Frightens Fish

"STOP talking—or you'll scare the fish" Many a fisherman has whispered thus. Is it really true? Can the fish hear your voice?

Experimenta have satisfactorily proved that sound made in the sir is almost enturely reflected when It reaches the surface of water therefore it is doubtful whether fish can hear even the loudest shouting.

What does disturb them when you talk is the usual accompanying movements. If you move your leet alightly when you speak, the actse your feet make against the bottom of the hoat is plainly heard by the fish in the neighborhood. After sitting still for a length of time you are apt to relax and move your body slightly. The fish hear every little movement through the bottom of the boat.

Everybody Flying in England

IN spite of England's recent atrolans sales, reports show that her civilian flying is increasing faster than ever before More than four handred commercial airplanes are now in use; in six months' time they have carried more than sixty thousand

In America, aviation is still considered a daring sport by most people. Commercial flying is almost non-existent; and very few people have flown at all. Yet statistics have proved over and over again that the number of sizplane secidents is no larger, proportionately than automobile and rastrond acridente

Why is thus country so far behind England in the air?

When Aluminum Explodes

A SMALL Wisconen town has a factory in which aluminum lip-stick containers are made

When the lip-stick containers are polished, aluminum dust accumulates. Mixed with the proper quantity of air and ignited, aluminum dost la about as explosive as illuminating gas. A spark from a piece of wire that had somehow worked its way into the surtion fan ignited the dust from the finabed machines and caused an explosion in the factory. Six girls were killed and six others injured.

The only scientists who seemed competent to handle and study the case were the grain-dust explosion exports of the United States Department of Agriculture To them the industrial commission of Wiscomma has turned for advice

Identifying the Birds

X/HO ham't heard the story that some VV birds mate for ife and that others return to the nest sites of yesteryear? Who was the man that first made these observations? On what did he base them?

To find out just how much there is in these familiar bird stories, the Biological Survey of the United States Department of Agriculture will continue the work inaugurated by the American Bird Banding Association. Birds are to be trapped in large numbers. Afterward identification bands are to be placed on their legs, and the birds are to be released. Subsequent discovery of the banded birds, when trapped or killed, will reveal their movements.

What Shall We Do for Wood?

NO one is more keenly alive to the abortage of paper than the publisher of a periodical or a newspaper. But even he does not resize what inroads he is making into our forests. According to Mr. C Price-Green, Industrial Commissioner of the Canadian National Raiway, the newspapers of New York city alone consume the equivalent of more than name thousand spruce-trees dully

And yet, it is not the printing industry that consumes the most wood. In sumber, ties, and firewood the United States uses up one hundred bilion feet a year

The total standing timber amounts to more than twenty-five hundred billion trees. Unthinkable as this quantity may appear, it will be exhausted at the present rate of cutting within fifty years. Already one half of our timber comes (rom Canada, and that cannot continue forever.

Potash that Contains Borax

POTASH, because of its alkaline qualities, is often put in the soil to result alive tire, is often put in the soil to neutralize acidity. A large quantity of it is obtained from Searles Lake California and now the Department of Agriculture finds that the potash in Searles Laur contains at least ten per cent of borax! Some samples showed twenty-three per cont of borax, And becar is injurious to crops

There are several potash companies operating in the Searles Lake district and they will undoubtedly have to find a new market for their product.

Airplanes Make Clouds

SHIPS were successfully hidden from the enemy by smoke screens during the war. How about airplanes? Can they manufacture clouds and make themselves invisible too"

The Government finds that surplanes actually do create small clouds by their swift passage through the atmosphere.

A temporary condensation of the atmospheric water vapor is caused and, under favorably moist conditions, glouds are formed.

Where to Buy Wild Animals

THE wild-animal business has been principally in German hands for many years. But now England has stepped in figuratively speaking-and is taking the wild-animal business away from her former enemy. A new company has been formed in London which claims that it can procure, within a reasonable time, any anemal desired.

The animals are well cared for from the time they are captured until they reach the buyer. They are given plenty of good food to eat and are kept in clean, sanitary cages. If you want a baby rhinoceros, let us know.

More Speed for the Movie Camera

Even a cannon-ball can be trapped by this extraordinary invention of a French cinematographer

By Lawrence Whiting

HE operator of the ordinary movingpicture camera is often called upon to record the movements of a bird or an anima, that is moving with flashike

rapidity

The Akeley camera is specially constructed and admirably adapted to this branch of rapid photograph) It has connecting joints so eas manipulated that the less can be pointed in any direction wishout meaning the swiftly moving image of the wild denizen of the forest. But thousands of other cameras are in use that are only occasionally called upon for this kind of photograp . and, not being adapted to such rapid following of the photographic object, the results are likely to be jump; complete faitures.

How can the ordinary moving-picture camera be adapted to this requiremant when it is badly

heeded"

An invention of Louis Janot, of Vincennes. France, has already solved the problem of passing a firm with sufficient speed through the camera to take pletures at the rate of one hundred and fifty a second or faster

Ordinarily the swift passage of the film carried by the teeth that engage the perforations on each side causes the film to tear. But the invention introduces two revolving rolls. or drums, bround which the flim is drawn before it in wound around the reel so that in comeres equipped for this ultrarapid photography the flux is not torn. There remains but the proper guiding of the camera to follow the object, which may be passing rapidly out of the field of view

And now this problem has been settled in an autonichingly

simple manner.

The carners is placed in a fixed position, and a longfocus lens, espable of giving a authorently large image of the bird or an mal that is to be photographed, is attached to the camera by a long, flexible ballows. To support this, an extension board has to be used. In front of the lens, on a movable support, is a mirror, which can be a plane piece of glass gilvered on the miriace.

In order to follow the reflected image, to be sure that it in projected upon the film through the eamers lens, a

sample view-finder is mounted in a con-

venient place. One operator looks into the view-finder and turns the mirror to follow the object. The image is thrown into the

The ordinary camera equipped for moce tly

Fitting the mirror to front of the lens of the ultra-rapid moving picture camera. M. George B. abrely the French cinematographer e was this useful device, who opens new fields in motion-picture photography, and which can be adapted to any comera

Showing the bild in Now the bird apkine - see with steeple in the foreground. end are made

prosches the cally CT B and the fast film Two hundred and mechanisms give fifty pictures a sec- every phase of the bird's twift motion.

less and is projected upon the film. The other operator turns the crank of the

> tion-pictures has an extremely short forus, and this produces very smal. amages which are only enlarged on screen its proportion to the whole. held of view. A flock of birds would appear merely as a flottering mass. the in hyiduals too small to be seen

> But when the long-focus camera is ased, the birds can be eaught on the wing as they approach in the distance. The marror is sighted and turned quickly to follow the swiftsy My ng birds as they draw near. Like a telescope it catches them when too

far away to be shown with the ordinary lens of the moving picture camera, and magnificat them as they pass overhead. The whole fluck may be too large to be included in the field of view, but some of the and vidual members will be enlarged as that details of their wing structure can be observed.

There are educational possibilities in this invention only to be appreciuted when it is tried in widdlife photography. telephoto - movie, hidden in a matable "blind" and having for reflecting mirror properly adjusted, heromes un important part of the auturalist's equipment. Concessed among the leaves he follows the swift leap of a deer or the rapid flight of a gout, or a mebra.

At a distance which would be far too great for distinct photography, the telescopic camera bags the game. As the speed of the moving object is magnified in propartion to the

size of the image, a rapidy working mechanism is neces-sary to "stop" the motion in each exposure. Otherwise the hird or rabout, or deer, would be h urred and indistinct.

The moreor device in the invention of M George E. Labrely, the French cinematographer. It can be attached to any motion-picture camera. The long-focus lens provide an enlarged or "closs-up" image of the bird in flight, and the, with the extension, can be attached to the ordinary apparatus when it is to be used for ultra-rapid photography.



The Wonderful New All-Metal Monoplane

As revolutionary as the first iron ship

By C. Dienstbach and L. J. Wilson

A FLASH of fire, a cloud of smoke, and down comes the wood-and-cloth airplane, a burning mass. Nothing of the kind can happen to the new all-metal monoplane, the latest innovation in aircraft. As solid as a battleship, and covered with corrugated sheets of metal, the monoplane looks too heavy to fly.

"If that airplane will fly," Colonel W. N. Hensley, Jr., said to the pilot who was about to take him for a flight in one of the huge metal monoplanes which he saw while in Germany. Imagine an all-metal monoplane having a wingspread of one hundred and thirty feet, and weighing eight tonal

The astonishing fact is that this heavy-looking machine will not only fly, but will fly with greater

reconomy of fuel, will fly faster and with three times the efficiency of other machines of its weight and size. What makes possible such a seeming miracle?

Dr. Hago Junker, the maker of aireraft and all-round genus of invention, found, by a series of wind-tunnel experiments, that he could, by the utmost economy of material, make a structure strong enough to withstand great stresses and strains and yet possess the power of cleaving the air in flight. It is an adaptation of this

Junker design that John L. Larsen brings to this country in the JL6 monoplane, a machine having a wingspread of nearly fifty feet and weighing 2246 pounds.

The Fastest Machine of Its Size

The utter absence of all exposed structural features, such as wires, struts, and bracings, reduces the resistance to such an extent that the huge metal bird cuts through the air with the ease of a gigantic eagle. What flying-machine of wood and cloth will carry from six to eight

Why Wasn't This Done Before?

THE world almost laughed when the allmetal airplane was proposed. We say "almost," because the spectacle of a man perishing in a machine that is one roaring mass of flame was too tragic an occurrence to cause mirth.

Now comes Dr. Junker with a new scientific study of resistance in the air. He discovers new facts. He shows that the allmetal machine is not a dream by building one, the practical results of which make it an eye-opening success.

Several weeks ago the staff of the Popular Science Monthly made a flight in this revolutionary machine. The present article is written as the result of that flight and of a critical study of the JL6 monoplane.

passengers at an average speed of 112 miles an hour, making use of but 160 horsepower? This is only one of the many wonderful possibilities demonstrated by the JL6 all-metal monoplane.

The propeller, driven by a highpower engine used in the typical biplane, churns up an enormous wind, strong enough to bend backward one's arm held outside the protection of the wind-shield. But if one puts his arm outside the window of the JL6, he is surprised to find so slight an air-stream. The propeller drives the machine that and of driving the air

'Metal is heavy," a mon thinks. To imagine tons of metal flying in the ethereal ocean overhead is not attractive to those who like the security of baving nothing heavier than a cloud above them Yet, when the weight of these all-metal machines is compared with that of airplanes of wood and cloth, and when the factor of relative strength is considered, the metal machine is both lighter and safer. Not only can it withstand severs atmospheric conditions, but it suffera less damage in case of a bad landing. In the wooden craft the machine upon crashing in often splintered. Comparisons between these and the metal planes used in the war show that the factor of eafety to pilot and pas-

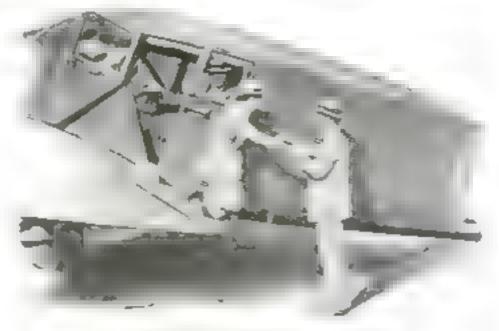
sengers was on the side of the metal airplane. The lesson of the steel sairond-care and the steel ship is repeated.

What Makes It Light

In the new JL6 monoplane the thick curve of the wing provides great lifting power. Therefore landing becomes possible at a speed of about forty or fifty miles an hour. The strength of the wing depends upon the simple cantilever construction of tubes and

> girders, which makes a tremendously strong frame within the covers of the corrugated sheets of sluminum alloy. In the thickest part of each wing near the side of the body are the gasoline-tanks, their position providing another factor of safety.

> The JL6 carries from six to eight persons, including pilot and mechanic. It completed a non-stop flight from Omaha to Lancaster, Pennsylvania, a distance in the air of about twelve hundred miles, at an average speed, against a cross head-wind, of 109 miles an



The tourists Palm Beach suit and white dress remain unsoiled in this fimousine of the air

hour, and consumed 105 gallons of gasoline in the trip. This flight was about four hundred miles better than the previous non-stop record in the United States.

In altitude climbing, the monoplane carried five people to a height of twenty-two thousand feet with an efficiency fully triple that of any surplane of today. In another flight it went from Atlantic City to New York with five passengers, one of whom weighed 277 pounds, and with 148 pounds of baggage, reaching an altitude of 20,600 feet, and establishing a world's record for the passengers carried and horsepower used. It was equipped with a Mercedes 160-horsepower engine and covered the entire distance in eighty minutes!

Cheaper than the Railway

The cost of air travel is totally

revolutionized by the economical accomplishment of the record nonstop flight from Omaha to Lancaster. Allowing 34 cents a gallon for gasoline, the fuel consumed amounted to \$35.70; the cost of the ol) used was about \$4.80; total cost for these, \$40.50. Three people and baggage were carried. When allowunce is made for the money inverted, for depreciation and wear, for wages, etc., the actual transportation cost would compare with the regular railroad fare for such a trip, and pay attractive dividends on the investment. Contrasted with a similar trip in an automobile, the expenses are surprisingly light, considering how long it would take the automobilist to make the trip involving stopovers on the way. What an advantage that there are no aerial speed laws!

The muterial used in metal aircraft construction, "duraluminum," contains more than ninety per cent aluminum, alloyed with copper, magnesium, and manganese. Weight for weight, a tube of this metal can be made three times thicker than one of steel. This means that any slight local fracture, such as a dent in the metal, would have less effect than the same imperfection in a thin tube of steel of similar weight. In the air the wings of an airplane are subjected to enormous strain. A serious defect would cause a structural tube to give way when too great pressure is thrown abon it. Thus a decided advantage seems to be obtained in the use of thicker material, and for this "duraluminum" is better than steel, though steel will withstand a greater weight than duraluminum. Other alloys of aluminum are also used in the construction of sureraft.

Only the brainwork of a genius could have so perfected the design and made it conform to the material used



The aluminum "hawk" speeds through the eir at two miles a minute. Here it is carrying passengers over the picturesque Potenne; in the vicinity of Washington

in its construction, in the making of this aeronautic wonder. To make the wing design successfully meet the material, Dr. Junker had to make a correction of the established E.ffel tables, which up to this time had been used in the design of aircraft. This was accomplished by means of the wind-tunnel experiments. It resulted in the birdlike features, in which everything tapers toward the outer ends, a feature absent in other airplane designs because the novel wind-tunnel tests proved it permissible.

Host It Feels to Fly

Traveling in this remarkable body of the metallic hawk affords novel sensations, even to one who has made flights in other types of aircraft. The comfort of the surroundings, the porsibility of conversation, the absence of the terrific wind experienced in an open "ship," the angle at which the pilot banks on the curves, seeming to "swing" the earth, produce curious feelings in the passengers. There is such a strange muxture of the normal and the abnormal. Here you sit in the midst of usual surroundings. You look out of the window and suddenly see the great dark platter of the landscape rise up into the sky. You look out of the other window and see nothing but sky. Then the realization that

you are aslant with the vertical comes over you. It is a queer feeling.

To all these actual impressions and observations there is a most significant scientific foundation. Well may the flying-muchine be an apparently heavy and clumsy object if we know that the wings can carry twice as much weight a square foot as those of other airplanes. This means they are twice as The sturdy, thick-set owl at rong shape can stand the storm that blows around it and will never stir except when the body and wings cleave the air in a certain way while flying. No wonder you feel an unreasonable apprehension about being supported two thousand feet high by a pedestal of metal as unlike a parachute as possible. But is it possible that such a thing supports more weight at less power— 160 horsepower for aix men and a supply of eight hours' fuel, and flies at the same time faster than other machines, yet lands at forty-five or fifty miles an hour?

Science Supplied a New Airplane

The answer is: the wind tunnel. It is the proved road to all real progress in aviation. Why did the Wrights fly? Because they built their own wind tunnel and discovered that all previous formulae were incorrect. Junker treated Eiffel's tables as the

Wrights treated Libenthal's, though the latter were a marked improvement over Langley's and Maxim's. The secret of the Junker monoplane is all expressed in the words real streamlining. In this machine the thick-set, roomy body cleaves the air more amouthly than the overslander fuselage with its

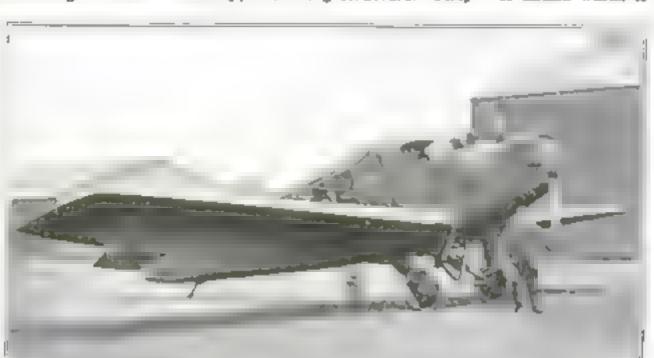
cramped quarters. The wings likewise have no useless resistance. only a sham fault, in that their high lifting power engenders an abnormal drift. But this is a emall. **Macrifice** that even pays for the advuntages it affords. How?

Simply because the extremely arched, or cambered wings may be usefully driven through the air a greater in-

clination than flatter wings. If high lift is required at relatively low speed—landing speed—the inclination is increased. With slightly cambered wings a point is all too soon reached where steeper inclination only increases the drift, while the lift remains unchanged. The Junker machine

gains speed in spate of the drift produced by the wing-curve. The absence of wires, struta, and bracings exposed to offer resistance saves sixty per cent of the propeller's efficiency, while the wing-drift costs ten per cent

leaving fifty per cent advantage over other types of wing structure. Fifty



Absence of wires and struts reduces the head resistance of the metal monoplane. With a one hundred and maty horsepower engine it makes high speed carrying eight people

per cent of the resistance offered by the exposed wires and strute of other types of aircraft are eliminated in this remarkable monoplane.

In the JL6 it is possible to turn safely while steeply ascending. In other types of machines this is dangerous because the resistance of climbing added to the resistance of struts and wires, and also the inefficiency of the wings at steep inclination, uses up the momentum and the machine soon comes almost to a stop, losing thereby control and support. The high lifting power of the wings relieves this state of affairs which is so aggravated by

turning, because the centrifugaforce is added to the wing load, and makes this feat possible in the wonderful monoplane.

The rule usually given student pilots by their instructors, "Never attempt a sharp turn while ascending," thus does not apply to the all-metal monoplane. With the ease of a glant bird it can make a corkacre weerles of apiral

turns while climbing cloudward

Speed, safety and comfort are the principal factors considered by the traveling public. Cost of transportation is secondary where a man's time is very valuable; but aerial transportation rates will be cheaper assoon as the method of traveling becomes more popular.

Making the Prickly Pear Fit for Cattle

O N some of the great farms in Texas they are now singeing the sharp, hard stickers off the prickly pears, so this peculiar variety of fruit can be fed to the entite. The growth of this large pear with its ugsy "stickers" is limited to the desert sections of the South

The spiny growth of the prickly pear is removed wholesale by the use of a large gasoline torch. A powerful portable torch has been devised by the Department of Agriculture, and by its use the heretofore useless fruit has been made to serve a purpose. After the peam are put under this treatment, the cattle can be turned into the field, where they may eat their fill of this large, juicy member of the pear family.

Another method of treating these pears to render them harmless is

by putting them through a chopper. Scientists of the Department of Agriculture who have made a study of the prickly pear, find that it is more digestible when it is chopped up

Experiments now being conducted along this line may bring the prickly pear from the status of an undestrable citizen of the desert to a law-abiding individual worthy of being developed and raused for cattle feed.



The prickly pear has been the bolshevik of the desert. They are now burning off its stickers with a gasoline torch

Prickly pears are chopped up for cattle feed. Here's a mass of them going through a cutter drives by a beavy gas-engine

Next Winter's Snow

How the Popular Science Monthly would keep city streets clear in winter and save millions of dollars

TEW YORK failed miserably in its attempt to cope with the mass of snow that clogged its streets in February, 1920. In fact, it has always been more or less helpiess in the face of a heavy snowfall. It takes days to clear the streets after a storm. Last winter it took weeks, because New York was overwhelmed by a blissard.

Street-car lines stopped running. Horse-drawn vehicles and motor-trucks were stalled in narrow streets, and behind them collected a long train of vehicles, waiting bour after hour until shovels slowly dug out the cork that stopped the neck of the bottle.

Clerks and factory employees had to walk to their work. There was a food shortage. Garbage and ashes

accumulated in piles in the streets. Mercifully snough, there was no serious fire; for the Fire Department could not move its apparatus.

Removing Snow the Old Way

New York's Street-Cleaning Department has always followed a single plan: It uses its own forces and equipment, and supplements them by hiring trucks and such unskilled laboreza as it can to shovel snow into wagons and trucks. Fifty cents an hour was the price offered to these outside laborers last winter. Fifty cents an hour! And this in the face of an unprecedented labor shortage, at a time when one dollar an hour was sniffed at by Italian ditchdiggero.

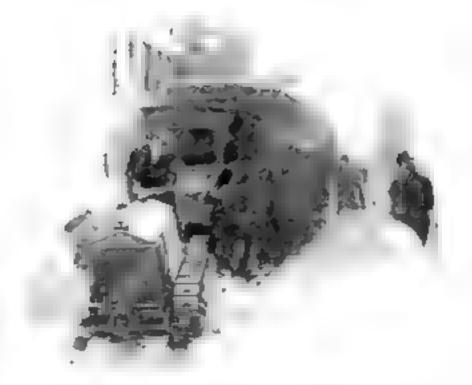
A few tramps and human derelicts appeared, and chopped and shoveled lazily. A few avenues were cleared; the city as a whole was buried in snow and ice. And these feeble attempts cost \$5,500,000.

Worse than this was the

business loss, which, according to the Merchants' Association, amounted to \$60,000,000 in those twelve unforgettable days, when snow, sleet, and ice blocked

the streets. Pive million dollars a day! Such is the price of mefficiency. Ten dollars for each man, woman, and child-that is what the distribution of this \$60,000,000 loss means.

A fire strikes terror. It does its work swiftly and visibly. A foot of snow in a great city is hardly less terrible. How many fires have caused a loss of \$60,000,000 to cities? You can count them on your fingers. They occurred at intervals of decades. Snow falls every year in our northern cities. We



The little tractor advertised its capabilities, but it would never have a chance if New York had developed a real mouremoval plan

expect it. Yet we never arm ourselves against it.

No one can tell whether we will have light or heavy falls this winter. But we can prepare for the worst type of snowfall that a large city north of Washington and east of the Rocky Mountains may expect. What we want is an engineering plan. We want that plan now, not when the snow has fallen and has been packed down into a caked mass by struggling vehicles. We want a plan that can be carried.

out as automatically, as quickly, as effectively, as a fire is extinguished.

How much does it cost to keep the streets open? Whatever the sum may be, it must be appropriated. It is cheaper to spend \$10,000,000 to save \$60,000,000 than it is to accomplish nothing by apending \$5,500,000, as New York did last winter for lack of an engineering plan. Money plus a plan will solve this problem; money without a plan will do nothing.

Popular Science Monthly Offers a New Plan

The Popular Science Monthly offers a plan. It is simple. It will prove effective in keeping the streets clean in any city. It is a plan that considers enow removal as vital as fire-fighting. It involves the expenditure of more money than has ever been spent in the past for removing snow. But it is cheaper than any pian that has ever been tried, because anything is cheap that will avoid a loss of \$60,000,000, and enable a city to feed

Show This Article to Your Mayor and Your Board of Trade

This is the fourth of the Popular Science Monthly's series of articles on business uses of the motor-truck. We have made it one of the series because streets must be kept open in winter if motor-trucks are to be run, and the motor-truck can help to keep the streets open.

New York was paralyzed for twelve days last winter because it had not adequately prepared for snowfalls. It lost \$60,000,000—about \$10 an inhabitant—because it had no plan. Maybe your city was paralyzed too. If it was, what are city officials doing about next winter's snow?

Read this article on the Popular Science Monthly's plan for keeping the streets open. If you believe in it, as you must when you think of last winter, then show it to your Mayor, or your Street-Cleaning Commissioner or your Board of Trade—perhaps to all. Remember, you pay the bill when the streets are clogged with snow.

The Popular Science Monthly will cooperate with any municipality that wants to carry out the plan here outlined, by giving all the technical information in its possession.



Some advocate the mow-plow that is dragged behind a motorvehicle. Such plows were used by auto buses in New York when the buses could run

New York has purchased three hundred and fifty pusher-plows for next winter, to be used with motor-trucks, but plows without a workable plan will not belp much

itself and to keep its street-cars and its vehicles moving

The essence of the Popular Science Monthly's plan consists in removing the enow almost as fast as it falls. No time must be given for accumulations to be packed down.

Use Plows with Motor-Trucks

First of all, the city is to be divided into sones, and the sones subdivided into sections. Every section in a zone is to be cleared by a motor-truck equipped with a plow. All the 314- to 5-ton trucks of the city are to be mobilized at once, when the emergency arises, just as fire-engines rush to a fire. True, plows do not remove snow. On the other hand, they do keep the streets clear; the snow pushed aside can be removed later. Keep the streets open —that is the first principle of the Popular Science Monthly's plan.

The idea of employing motor-trucks in subdivided zones is not new. It has been tried, and it has failed because human nature was not considered About thirty dollars a day has been paid in the part for the use of a five-ton motor-truck in snow removal. Too little—much too little. What happened? When the truck-owner received an offer of fifty dollars a day from some merchant bent on making the attempt to ship his goods despite the prevailing conditions, he ceased then and there to remove snow, even though he violated a contract with the city.

Clearly, the price to be paid for the truck must be so high that there is every inducement to keep it at work plowing snow

But that is not enough. The motortruck must begin to plow as soon as the call comes—at two or three o'clock in the morning, if necessary. What of the driver? Will be respond cheerfully when aroused in the dead of the night? Not if we know human nature. must be made worth his while to get up as promptly as a fireman when the bell in the engine-house clauge. He, too, must be paid by the city-paid over and above what his employer pays him in wages. It may be that the driver will earn three, four, even five dollars an hour while he is plowing snow. But the Popular Science Monthly's plan takes account of human naturesomething that has always been ignored in facing this problem of snow. Beardes, it is cheaper to remove the snow at a high cost than to peck at it and not remove it at all

When Jones, driver of the A. B. C. Express Company's truck No. 25, is awakened at might and instructed to proceed to Section 10 in Zone 2 and plow snow, he will go cheerfully to his task, because he knows that he will make several times as much money an hour as he ever made before in his life.

When the emergency call comes, Jones goes to the nearest station of the Street-Cleaning Department, gets one of the standardized snow-plows, at-

taches it to his truck, and proceeds to his district. there to place himself under the orders of a fore, man of the Street-Cleaning Department and to remain under those orders until he is released.

Unless Jones is paid by the city, and well paid, in addition to the wage that he receives from his regular employer, the truck-owner, neither this nor any similar plan will succeed. Human nature must be considered—the psychology of the truck-driver and of

the truck-owner. We are dealing with an emergency. Emergency tasks must be paid for at emergency prices. Otherwise those who perform them will not look upon them as amergency tasks.

The Need of Cooperation

Contractors, express companies, railways, merchants, every firm that owns a motor-truck, must cooperate in clearing away the anow. But suppose that, even at the high price paid for the use of a truck, its owner insists on using it in his business? If, in spite of adequate payment, according to the Popular Science Monthly's plan, the truck-owner still refuses to cooperate—what then? The police must step in.

The man who attempts to haul goods after a certain depth of snow lies in the streets, before the plaws have had an opportunity of completing their work—that man must be summarily stopped. If necessary, he must be punished by the revocation of



What could pick and shovel do in the face of tons of mou? Only efficient machinery could deal with the problem

his license. He must not be allowed to pack down the mow. If he is not allowed to operate his truck in his own business, he will cheerfully use it to earn money in clearing the streets.

For a few hours, at the most, will it be necessary for the police to interfere. Some streets will be designated as one-way streets, so that vehicles may travel down the path plowed in the middle. Not until the plowed anow is removed will two-way traffic be resumed. Last winter no wheel moved in either direction. New York was stagbant for twelve whole days.

Time Is the Essence of the Problem

Plowing the streets, then —that is the first step. Next comes the actual physical removal of the snow. In the past, New York has tried ineffectually to keep its streets open by removing the snow in the very first instance. Thereby it complicated its problem enormously. To shovel snow into wagons and remove it

hodily by the thousands of tons is of necessity a time-consuming task. And time is the very essence of this problem. No large city can afford to lose days. And, we repeat, New York fost twelve whole days last winter.

The Popular Science Monthly's Plan for Snow Removal

- Make mow-plowing an emergency task, like putting out a fire.
- 2. Mobilite all the 3½- to 5-ton motor-trucks in the city under the orders of the Street-Cleaning Department. Equip each truck with a standardized and municipally owned snow-plow, and amign the trucks to plowing in a definite section of the city. This must be done now—not after the snow has fallen.
- Store city-owned anow-plows, which can be attached to motor-trucks, in convenient stations throughout the city. Let the truck-drivers proceed to these stations for plows when they receive the emergency call.
- Pay the truck-owner more than he can receive for hauling, so that he will not be tempted to violate his contract with the city.
- 5. Send each truck out to plow snow as soon as the emergency arises, even though it be in the dead of night. Pay not only the truck-owners high rate for the use of his truck, but also the truck-driver, in addition to his regular wages, so that when the call comes the driver will respond cheerfully.
- Empower the police to stop all traffic until the streets are plowed. After the streets are plowed make some of them one-way streets.
- When the storm is over and the streets are plowed, remove the enew by excevating and dirt-handling machinery
- Inspect the trucks and the enew-removal equipment before and after they have done their work, so as to avoid unjust claims for damages.

The Popular Science Monthly's plan provides for snow removal by machinery, where machinery can be effectively used. New York did make the attempt to use excavating machinery, tractors, and army "tanks"; but

it placed its chief reliance on picks and shovels.

It so happens that the excavating and dirt-handling apparatus of contractors is usually idle in the winter months. To make arrangements for its use in removing snow from plowed streets ought to be no difficult matter for the municipality. Snow should be handled by the cubic yard, and not by the shovel.

The City's Part Requires No Heavy Investment

The Popular Science Monthly's plan involves no heavy investment on the part of the city for snow-handling equipment. It must buy several bundred show-plows that can be attached to motortrucks; it must store these snow-plows at designated stations; it must inspect the motor-trucks that do the plowing before and after they have performed their duties, so as to avoid unjust claims for damages. And that is all, so far as equipment is concerned.

Consider the beneficent results that will be enjoyed

by any large city that has a really workable plan for snow-removal when the next great buszard comes. If handled efficiently, the delay should be so slight as to be almost imperceptible.



New York and other large cities failed salaerably in attempting to cope with the anowfall of February, 1920. People had to walk to work. There was a food shortage. New York alone lost \$60,000,000, because it used antiquated methods

New York to Have the World's Biggest Radio Station

The six antennae can be operated as one unit

REMEMBER how it was in the sarly days of electric traction, electric light, and power service, or telephony? There were small companies with isolated stations, each pursuing an independent policy in engineering development and business expansion. Now we have large units supplying huge territories; and husiness men have learned to rely absolutely on the continuity of the desired service.

Radiotelegraphy and radiotelephony have also passed through the stages of experimental development. The huge station shown in the picture on this page will help American business men to form the babit of radio communication. In it the best apparatus design of the engineers of the General Electric Company is combined with the operating experience of the Marconi Company. The building contracts are now being let and construction will soon be under way. Ten square miles, sixty-four hundred acres, will be needed for the antenna systems and buildings. Six long lines of steel towers

By John Stuart

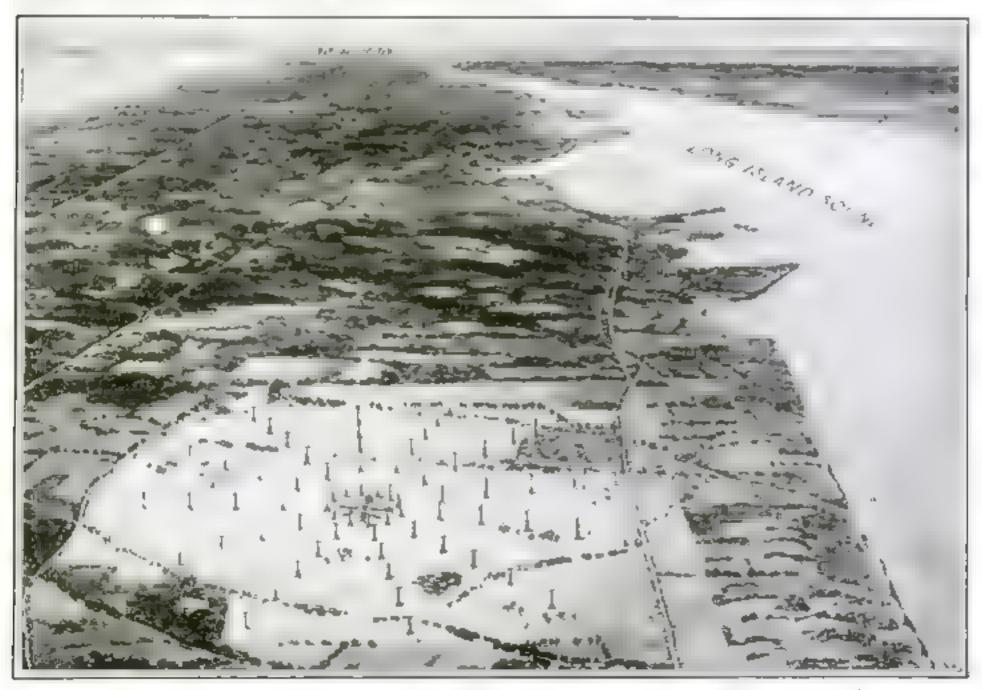
meet at a single point where the transmitting apparatus is located. Each line carries the antenna of a high-powered system. Five of these will operate with France, Germany, Poland, Sweden, and other European countries, and with important cities like Buenon Aires in South America. The mith is for insurance of service.

The wires of each antenna will be suspended from cross-arms 150 feet long, which are supported by steel towers each 400 feet high. The power for each antenna will come from two special generators, designed by Alexanderson of the General Electric Company. Each has a capacity of 200 knowatts.

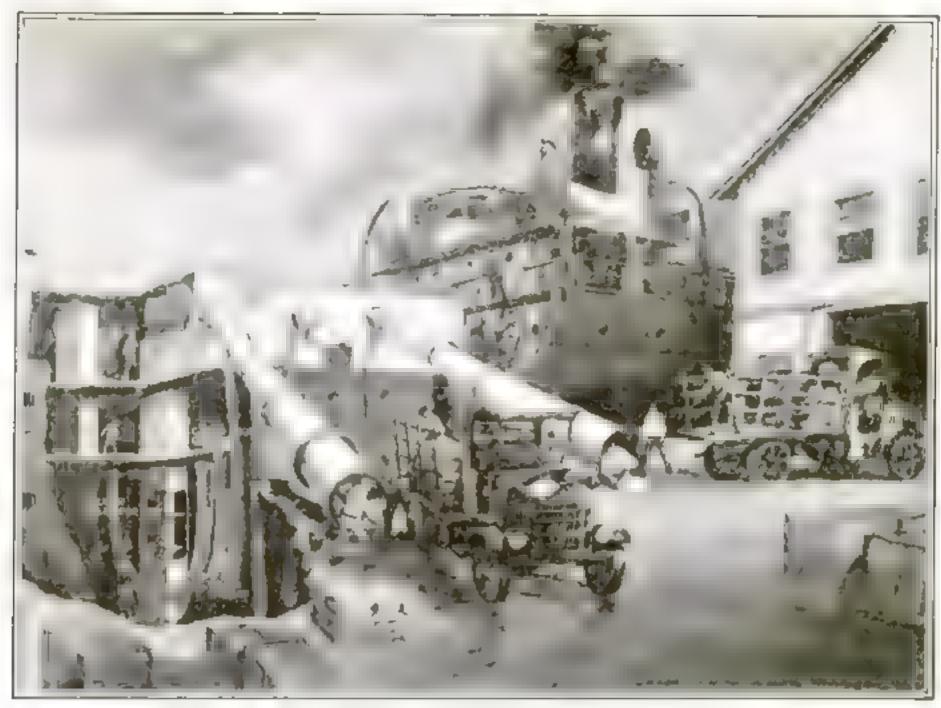
When occasion requires, all six of the antennes may be connected, forming a station with a capacity of 2000 kilowatts. On the other hand, each of the antenna systems may be operated as two, giving twelve spokes to the radio wheel and permitting twelve amultaneous messages.

For the high-speed transmission of telegraphic nignals there is the Hoxie beceiver, which makes a photographic record of signals too fast to be disunguished by the human ear. Messages are sent by a mechanically operated switch instead of by a key, the speed of which is limited by that of an operator's hand. At the receiving station they are detected by a vacuum-tube detector and then caused to actuate a small light mirror. The motion of this mirror flicks a beam of light back and forth across a moving tape of photographically sensitive paper. Operators then read this tape, writing out the message or re-transmitting it over land telegraph lines.

This station, which is located sixty miles from New York, at Port Jefferson, Long Island, will only transmit. The return messages will be received at another station about eighteen miles away. Both the receiving and transmitting stations will be connected by land lines to the office of the Radio Corporation on Broad street in New York city and operated from it.



The world's biggest radio station, at Part Jefferson, Long Island. Ten square miles will be needed for the antenna systems and buildings. It will be a transmitting station only; a receiving station being built elsewhere



Elevating devices and movable chutes handle the unloading of a ship in half the usual time

Saving Time in Unloading Ships

THE first large steamship, the Great Eastern, was a financial loss partly because it took too much time to load and unload her cargo. It costs \$3000 a day to hold a modern transatiantic steamer at her pier.

An invention of Gibson L. Douglass, of Duluth, Minnesota, promises to revolutionize the unloading of vessels

at their docks. It consists of a number of elevating devices and telescoping movable chutes installed in the ship, by means of which material such as sacks of cament, flour, and packages of various kinds may be quickly handled. A day's work in unloading by hand can be accomplished in a few hours by the new system.

Elevators near the ship's center are connected with telescopic conveyor spouts. The material to be unloaded is sent through the chutes by gravity, keeping the stavedores steadily employed, delivering the packages directly into the conveyor tubes. The "telescope" feature adjusts the tubes to the height of each deck.

Liquid Fire for Exterminating the Corn-Borer

GET the oil-tunk ready and prepare to apray the stubble in the field with liquid fire! Burning is the surest way to get rid of this obstinate and disastrous pest of the cornfield, the corn-borer.

The European corn-borer has made its appearance in certain sections of this country, probably being imported in cargoes of raw hemp which came here from abroad. There are two generations a year of this dangerous pest, and the cornfield infested is a center from which it



Spraying a stubble field with bouid fire to destroy the comborers. The insects infests the weeds as well as the comfield

spreads. The Department of Agriculture has undertaken the task of helping the farmer to get rid of the insect which takes the profits from his labor.

The corn-borer works under the cover of the cornstalk, and is not accessible to blackbirds, flies, and other natural enemies.

Plowing the infected stubble and burning it, or spraying fire in the stubblefield, is the most effective way to destroy the larvas of the insect. As many as a million borers may infest one acre of corn.

Why Oil Is Driving Coal from Ships

The Olympic will save \$1,300,000 a year

II. is taking the place of coal on the high seas. Sweating, half-naked stokers have disappeared from the leviathans of the ocean, and instead only a few furnace-tenders are seen in the boiler-room.

But that is not the reason oil was adopted. It gives more power and reduces boiler repairs by getting rid of clinkers, which injured the lining, and it also takes up less space. There is no loss of fuel in "dead" hours, because the fires can be lighted instantly and brought to the right temperature in forty seconds. Fires can be shut off at once in case of emergency. Since the furnace doors do not have to be opened for continual firing, there is a more equal distribution of heat. There is also less accumulation of soot on the boiler-tubes. King Oil has deposed King Coal in the boiler-room because in every way he serves the requirements far better than does coal.

Eighteen years ago the first oilburning steamship, the Arab, made a voyage across the occen. To-day about two thousand vessels have been equipped to burn oll, and it will not be long before every steamship will have ceased to burn coal in its present cumbersome form. The Olympic, recently equipped as an oil-burner, furnishes excellent proof of the extraordinary advantages achieved in this respect. Figures show that the annual saving will reach \$1,800,000, and this entirely disregards the lower cost of oll compared with the present price of conl.

How Oil Compares with Coal

The first overseas trip as an oilburner shows that the steamship maintained an average speed of 21.5 knots an hour, as compared with 20.5 with coal. At this rate, twentyone trips a year will be possible instead of the usual twenty. Two main engines of 26,000 horsepower, and an additional directly connected turbine engine of 17,000 horsepower. drive the Olympic on her course. In the fire-room are 159 furnaces with five single-end and twenty-four double-end boilers. An electrical indicator in the boiler-room shows the number of fires required at any time. Tank space for 5200 tone of oil in provided.

To put coal into the Olympic's bunkers took 140 men working from three to four days. Seven men accomplish the equivalent of this task in six hours, piping oil into the tanks. Coal produced such an amount of dirt that a whole day was

By Latimer J. Wilson

spent cleaning up the ship, while complete repainting was necessary after every alternate trip. Just consider what this and other savings amount to from the viewpoint of finances! Allowing 3½ days and 133 men each voyage, at \$3 a day, the amount saved on bunkering slone is \$29,327 a year, counting 21 trips instead of 20. Oil releases 1000 tons of cargo space each trip, estimated at \$525,000. Owing to the release of 153 extra firemen, more passenger apace is provided, giving a further saving of \$491,400. The wages saved by the release of the 153 firemen amounts to \$165,240, while the cost of their subsistence, \$82,620, is an additional saving. The total annual saving thus amounts to \$1,293,587.

Burning the Oil in Atr

To obtain the full heating value of any fuel there must be complete combustion, which, expressed broadly in chemical terms, means that every atom of carbon in the fuel must combine with two atoms of oxygen. Every atom of carbon that escapes up the smokestack, combined with only one atom of oxygen, carries away a part of the heat-producing quality of the fuel

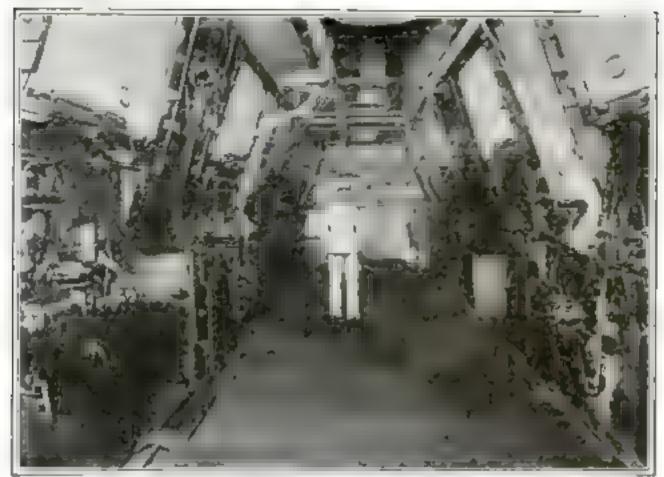
When any fuel is burned it is necessary to admit enough oxygen to permit the free combination of the carbon and oxygen-forming carbon-dioxide, the product of combustion. The air readily gives up its oxygen to the carbon. This is illustrated by a piece of paper lighted in the open, which burns completely. But if it is enclosed in an airtight compartment, such as a glass tumbler having a tight cover, it will burn only a moment—just long enough to exhaust the oxygen in the imprisoned air. To obtain the best results from oil as a fuel, it is necessary to regulate the air admitted to the furnace.

The Latest Oil-Burner

The oil-burning installation on the Olympic is obsolete compared with the very latest type of oil-burner being installed in steamships and industrial plants which differs from the old by permitting an accurate adjustment of air admitted to the flame. The oil is pumped into the storage-tanks, and, before passing to the burners, it is mechanically strained to remove particles of grit and sand, which are held in suspension in the crude oil from the wells. This foreign material is caught and collected in the strainer baskets. which are cleaned out about every twenty-four hours. The strained oil is heated to temperatures from 150° to 300° Fahrenheit, according to its character. With a compression pump the heated oil is sent under a pressure of about eighty pounds to the square inch through another strainer. This



The boiler-room of a coal-burning stramship. Note the dirty quarters and imagine the best and grime accompanying the furnaces and roal-shoveling



This is the same room with the boilers equipped for oil-burning. The most immaculate of summer uniforms can pass through unscathed

eliminates the possibility of any foreign material reaching the atomizing device to which it passes to be aprayed in the form of a cone.

The burner and air-regulator, the latter a strictly new feature developed by Walliam H. Todd, are installed in the furnace door, as shown in the plustration.

All Oils Not Alike

The oil is heated to reduce its viscosity or body, so that it will flow rapidly to the burner passages and be easily atomized when it issues from the small hole at the tip of the spray

Crude oil varies greatly with the locality from which it is obtained. Even the run of oil from the same

well varies in quality. Some oils are heavier than others. some more viscous. have to be heated conelderably before reaching the proper state of fluidity, while others at normal temperature are almost ready for the atomizing device in this respect. When oil is heated it gives of vapora, which finally permeate the mir to such an extent that the mixture of air and oil vapor becomes an explosive mixture, combustion taking place instantly. This point is called the "flash" point of a grade of oil and it differs in degree of temperature in various grades of the oil, some having a higher flash point than others.

The oil sprayed into the furnace under the boilers burns continuously at a degree exceeding that of the flash point. This degree of temperature is defined as the "firing-point"

of the oil, and it indicates a heated vapor that will burn continuously when ignited in air. Oils having a flash point of 150° F. and over, can be stored safely. The firing-point of oil is about fifty degrees higher than that of the flash point.

When the fine spray of vapor is propected under pressure into the furnace,
one can readily see how important it is
that the vapor should be thoroughly
mixed with the air to assure perfect
continuous combust on. The air is
heated to prevent the chilling of the
flame. Both the oil and air, before
being admitted to the furnace, are
raised to the proper temperature with
steam from the boilers. While too
little air mixed with the atomized oil
produces incomplete combustion, if

The oil-burner installed in the furnace door A cone of flame is sprayed under the boiler, the amount of sir being regulated

too much air is admitted the heat of the 'flame will be partially wasted in the heating of the surplus air. Thus with both the fuel and the air raised to the proper degree of temperature, and with an exact regulation of the amount of air, perfect combustion occurs. One sample of oil at a constant pressure may require little beating to produce efficient results, while another may have to be raised to a relative high degree of temperature to assure efficiency.

Cost of Operation Is Less

Financially considered, the total saving in operating costs using oil as fuel varies from thirty to seventy per cent, depending upon the type of ship or power plant. Each installation has its particular problems which can be efficiently met, sometimes only by experience.

Oll does away with the handling

of ashes. It banishes the nussance of smoky cities, and produces less soot to clog the smokestacks. Estimates based upon plants operating with oil for fuel instead of coal give such results as these; a twenty-five per cent reduction in expense of firemen; a sixty-five per cent reduction in fuel consumption; ash-handlers, coalpassers, etc., reduced to nothing; a ten per cent reduction in bunkering time; and a sixty-five per cent increase in storage space. This alone is a good argument in favor of using oil instead of coal for the fuel of industrial plants, private furnaces, ships, and even railroads.

The Cunard liner Aquitagen furnishes still another instance of the value of oil as fuel instead of coal. She left New York for Cherbourg on July thirty-first, equipped the same as the

Olympic, with the mechanical oil-burner invented by William Albert White.

The last 129 miles of the Aquitanta's voyage was made at the record rate of 27.40 knots an hour, truly a good rate of speed for an ocean-going steamship.

In the near future it is likely that this record will be surpassed, and even more time will be saved.

The instances of these two great ships converted from coal- to oil-burners demonstrate that the principle of using oil instead of coal affords the efficiency which makes for greater speed, not to mention the greater cleanliness and economy

Look to the future for the development of the oil-fuel age! Only the exhaustion of our natural resources will stop the great advance.

A Controller on Deck Directs This Ship Like a Trolley-Car

THE latest invention in marine engineering, the yacht El/ay, comes into port with the navigating officer manipulating a control bandle similar to that used by a trolley-car motor-

If the officer wants the engine to stop, he merely turns the handle of his controller to the "off" position. To go forward, the handle is swung around to the left. A number of notches give increased speeds. To "back up," the handle is moved around to the right. Before the officer's eyes is a panel with a number of instruments that give full information as to the operating condition of the machinery.

Thus the boat in absolutely under the navigator's control. A word to the quartermaster at the wheel changes the course: a touch on the controller changes the speed or the boat's direction And the "liveliness" of this control can be judged from the fact that the propeller can be changed from full apeed ahead

to full apeed

astern within a short five seconds. Of course, electricity in the only power that can be controlled so conveniently. But the Elfay is more than an electrically propelled bout-she is the first craft in the world to use the system of propulsion known as the oil-electric. There are other electrically propelled boats, which obtain their power from storage batteries, steam turbines, or gasolme-engine-driven generators: but the Elfoy is unique in that her main engine is of the Diesel type

The Elfay's main engine is a Winton full Diesel oil engine of one hundred and fifteen horsepower, which open ates a peventy-five-kilowatt directcurrent generator. This generator provides nurrent for a ninety-horsepower motor directly connected with the pro-

The angine and generator are started in the engine-room. The engineer's duty is merely to keep them running continuously at constant speed. The control of the propeller motor is centered in the controller on the deck, so that the engineer has nothing whatever to do with the actual operation of the vessel.

There is a pine-kilowatt exciter, which excites the fields of the main

generator and the main motor. In the main generator field circuit there is a field rheostat controlled by the control handle on deck. Moving the handle to the off position, the field circuit is broken between the exciter

This is the yacht Alfay's control handle that turns the current on and off Severat speeds are obtainable

The yacht Ellay, the controls of which are similar to a trolley-car is equipped with an oil engine and an electric generator and motor

and generator. The generator has no field, and consequently does not deliver current to the motor, and the propeller does not turn.

Moving the control in a forward direction first connects the generator field with the excitor, and then gradually decreases the resistance in series, thus permitting the generator field to increase gradually, every increase in the strength of field, current of greater voltage is supplied

the motor, thus increasing its speed.

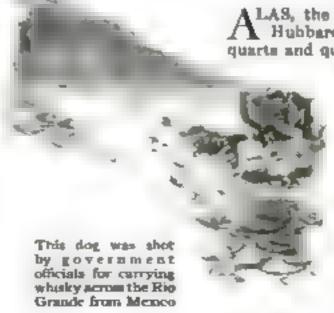
Many engineers believe this drive to be the most nearly ideal for merchant vessels of small and moderate capacity. because of the high fuel economy of the ail engine, the reliability and flexibility and same of control of the electric power, and the great safety obtained through the use of several small engines and generators, so that one or more can be out of commission without crippling the ship.



ALAS, the poor doggle is dead-not Mother Hubbard's dog, but the dog that smuggled quarts and quarts of whisky from Mexico to this

> land of the free. Every night be swam the Rio Grande at least a dozen times, carrying on his back, each trip, four full quart bottles of whisky. He changed his route each night, and thus for a long time he was able to evade the law. Finally, however, he was detected and shot.

If that dog had lived for ten years and had carried on his neferious work, there would have been nearly two hundred thousand extra quarts of whisky in this country!



He Carries His X-Ray with Him

FOR many years the X-ray has been the invaluable ally of surgery and medicine, but until recently it has been necessary always to transport the pattern to the laboratory. Now, however, there is a portable X-ray outfit

It is possible for a doctor to transport the entire appara-

tus, patked in four bundles, to any house wired for electricity, and produce radiographic results as good as those secured in a completely equipped X-ray laboratory. The process of operating the machine is simplified by control systems enabling him to use the exact ray intensity he needs. A time switch accurately controls the length of each exposure. With these adjusted, the doctor merely presses a button and the machine does the rest. An ordinary incandescent-light circuit will supply all the necessary current.

The device is meant also for hospital use so that it can be taken to the bedade of patients who cannot be conveniently moved. The results produced with this outfit are comparable with those of any ordinary X-ray machine, except that its power is too low for instantaneous gastro-intestinal

radiography.

The portable set has been consolidated and simplified over the army type familiar to medical corps men. The bulb itself has been reduced in also to two and one half inches. By making the tube of thick lead glass, the total weight of the tube and its protection has been reduced five pounds, with a consequent lightening of the frame that supports it. This lead glass contains about fifty-seven per cent metallic lead, and in its resistance to X-rays is equal in protective power to lead one sixteenth of an inch thick

The new tube rectifies its own current, thus doing away with a heavy, bulky rectifier and adding to the efficiency of the set as a whole. The



This patient was unable to go to the X-ray laboratory, so the laboratory went to him. This new outfit can be carried in four cases

By making the tube of this X-ray outh of thick lead gloss, its weight a greatly reduced. Similar reductions in weight throughout make it easily portable

transformer has been reduced in size by the use of smaller windings and a case shaped to fit the coils. Minimum weight and bulk is secured in all other parts of the outfit by a careful choice of materials and a study of sizes and shapes. Thus, when the device is ready to be taken out for use, it can be put easily into the tonness of a small automobile and as easily carried in or out of a house.

One of the obstacles to radiography

In houses is the variation in circuits between city and city or even between different parts of the same city. This is overcome by the control system of the portable outfit by means of which it is possible always to deliver the same definite voltage to the transformer primary.

Thus under all ordinary conditions the new portable apparatus can be used almost anywhere with case and

весциясу

A Machine that Harvests Crimson-Clover Seed

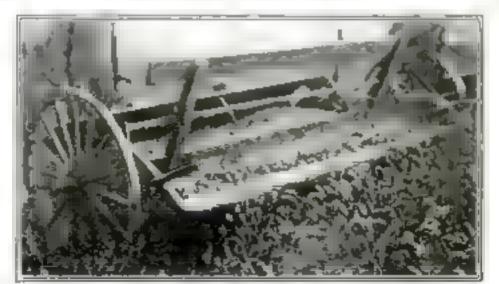
THE heads are chopped off crimson clover and the seeds subsequently removed for future sowing. Heretofore a mowing-machine has done the

beheading, but the Department of Agriculture has recently developed a new machine that does the job more efficiently

It is a rotary harvester, equipped with long narrow guide teeth that travel close to the ground, gathering clover large and small. There are wide, rounded spaces between the teeth, thus preventing clogging. The teeth plow through a field of clover, pulling off just the heads.

Clover ought to be

stripped when about three quarters of the seeds are ripe. Loss of seed is then negligible. But the machine must do some hard



Long, narrow teeth projecting from this machine chop the heads off clover with practically no loss of sceda

pulling in order to get the heads off. The teeth should be set close to the ground.

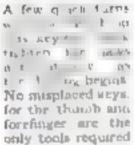
If the clover is dry, the hulls strip readily and the teeth may be raised. A lever at the side of the machine is used for raising and lowering them. Ten acres of clover seed can be stripped in a day when one man and a team of horses operate the machine.

Do It with Tools and Machines

New things that aid the shop manager to speed up production



At last up sestru perce that we reserew. A few pounds' pressure at the end of the upper bar and on the ratchet hardle will suffice to fe move the screw

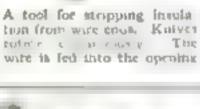


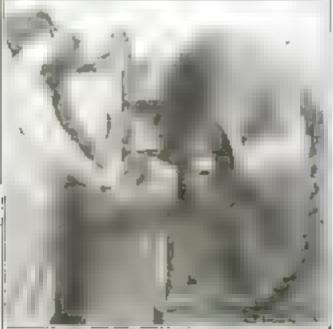


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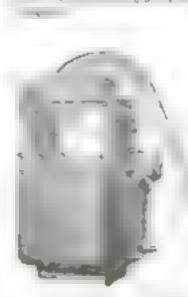


mesh in exampled for this screening machine. The there





Chatting through a thony five conhicarbon. steelingot i toes rotary says nob. As the inserted teeth are worn, they are removed and sharpened, or new teeth are inserted



A new tool for electrical workers in the ful arrawa are over. The bend is of insulating material and is safe for workmen to use



Eliminating Some of the Hardships of Housework



Don't your makes nate of a droping the state of a case. The side frames above has cares for part to its for caps and aperture nations. A grip pan catches the side, was or you pour wer he inh a



When using an election value of each regard often flaget the cord and the lark received you of the each his A long weight torus a comprehenging the between the two



When you is trave my, a

hair brush isn't risch good if you haven't a circo. The

two are been on barred ac-

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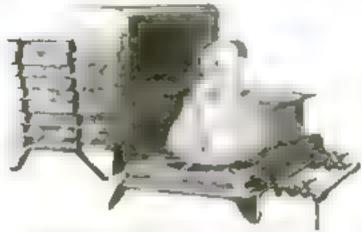
they look like a soap con tumer and can be easily

Careara)

We may be east a ter on terms to a term to a term to the terms to the term



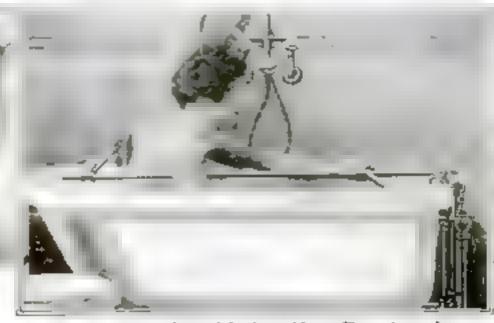
Years ago duty clothes went in they have a total a lathes har per a total of years. Wicker to year per at proper year at a confidence of a wooders may if eptilistics is provided for



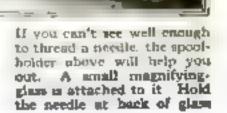
I we the heat sudunting to us the go beened of che it of by ere ting a color at the bank of the store



No cr2 Fill a soup plate with water place you butter in it, and cover with a flower pot. The pot absorbs the water and keeps the interior cool.



There is a mechanical back scrubber. You adjust the brush, fasten it to the rod, and move the handle up and down







Nicholes Bauer Adrian, Mann. Aga 15

school students.

TN January, 1919, the Popular

for by high-school and preparatory-

United States into ten groups, the

best student in each group to receive

a \$500 scholarship, the prize-winners

to be selected by JOHN F. WOODHULL,

Professor of Physics at Teachers Col-

lege, Columbia University; Professor

ALTRED E. BURTON, Dean of the

Massachusetts Institute of Technol-

ogy; and Dr. C. R. MANN, Chairman

of the Advisory Educational Com-

which was based on the May, 1920,

POPULAR SCIENCE MONTHLY, was taken

In their own schools by more than five

thousand students, of whom the fol-

lowing ten, representing the best in

EVERETT CARMAN, Central High School,

NICHOLAS A. BAUER, High School,

J B. McConnell, Southwestern Junior

RUSY PAINTER, High School, Alham-

R. L. KRUMMEL, Central High School,

each group, received acholarahipa

Mid-Aliantle Group

Control States Group

Adrian, Minn.

South Control Group

Western Group

bra, Cal

Prairie Group

Great Lakes Group

South Atlantic Group

New England Group

cania Group

town, Pa.

New York Group

Syracuse, N Y.

College, Keene, Texas.

Kansas City, Mo.

MAURICE V KING, Jr.,

West Technical High

EARL MCBER, High

School, Cleveland, O.

School, Enney Ala

LORDEN G. HOOKER.

Mt. Herman School

GEORGE E. HAPPELL.

High School, Saeger-

HENRY J MACMILLAN.

Central High School,

Mt. Hermon, Mass.

New Jersey and Pennsyl-

Washington, D. C.

On June 2, 1920, the examination,

mittee, United States Army.

SCIENCE MONTHLY made a \$5000

acholarship offer, to be competed

The contest committee divided the

Ruby Peinter Alberthre, Cal. Age 17

H. J. MacMillan Syracuse, N Y. Age 17

A Composite Best Paper

The composite "best paper" below is made up of the best answer to each of the ten questions in the scholarship contest paper. Some of the individual best answers were made by contestants who were not prize-winners.

Question 1. LORERY G. HOOKER, Mt. Hermon School, Mt. Hermon, Massachu-

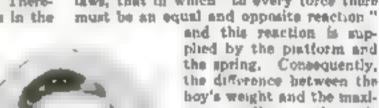
to curve. The baseball is spinning, for instance, in a clockwise direction (direction of arrow within the circle B). The bal. causes the air immediately surrounding it to spin with it (denoted by the four arrows outside the circle. The ball B is moving in the direction the arrow D points. Therefore the wind against the ball acts in the

the wind against the ball

would move to the right. It would be an "inshoot" to a right-handed batter

Atmospheric pressure causes a basebal.

direction of the three arrows W. Thus, on the left-band side of the ball, at O, the current of air caused by the spinning of the ball opposes This enposition of aircurrents decreases the velocity at O, while the velocity on the right-hand ude of the ball is increased by the wind. It can easily be proved (by blowing between two sheets of paper) that an increase in the speed in which air moves decreases the pressure. Therefore, there would be produced at D a low pressure, and at O a higher pressure. The ball, then,





10 14 Ensley, Als. Age III

than daylight, and so causes objects to have different intensity of color in artificial light. This can be remedied by having a concave checkerhourd reflector of blue, purple, and green. As the

artificial light strikes the reflector, the blue, purple, and green will absorb the red and yellow light. This makes the resulting light just like daylight. Of course, the room in the checkerboard will have to be arranged differently for the different kinds of artificial light to give the desired effect.

By this means an artist can point at any time when he receives an impiration instead of having to wait for daylight. In industries where color is a very important factor, such as the textile industry, it wil be found very valuable and the work can

Question 4. GEORGE E. HAPPELL. Saegertown High School, Saegertown, Pennaylvanua.

Electrolysis of gas-paper is caused by stray currents of electricity and the presence of acids in the soil. It generally occurs where troller lines are present, the company using the rails for the return part of the current. Part of the current escapes



Lorren G. Hooker Mt. Hermon, Mass. Age 20

of rest, it takes some external force to change that state. The balance has been reading the earth's

attraction, due to gravity. on the boy, or his weight. When he arises, he exerts

Ouestion 2. R. L.

When a boy jumps from

KRI MMEL, Central High

School, Kansus City, Mis-

a putform suspended

from a large spring bal-

ance, the balance was

show a momentary large

reading. The explanation

for this brings in one of

Newton's laws, that of

mertia. As the boy has

been remaining in a state

70

All Winners—of Our

Popular Science Monthly is

The Questions, Based Monthly for

1. (a) What makes a baseball curve? (b) Explain, in detail, the physical prinriples involved

2. (a) If a boy jumped from a platform suspended from a large spring balance, what effect would this have on the reading of the balance? (b) Explain the scientific principle involved.

3. (a) Explain how daylight may be closely imitated by the use of the "checkerboard reflector " (b) How will this aid industry?

4. (a) Explain the cause of the electrolysis of gas-pipes, and describe at least one way of preventing it. (b) How is electrolysis employed in clectrotyping?

5. (a) Explain fully how you would construct a dry-cell from tanfoll (b Give some causes for trouble with automobile batteries.

a force with his muscles to counteract his inertia. Then comes another of Newton's laws, that in which "to every force there must be an equal and opposite reaction "

> plied by the piatform and the spring. Consequently, the difference between the hoy's weight and the maximum reading on the scale will give the force he has exerted in rising

> Question 3. LILLIAN LEWTON, Central High School, Washington, D C

> Artificial hight contains more red and yellow light

keep on going after amidown.

\$5000 in Scholarships

proud of these young Americans

on the Popular Science May, 1920

6. (a) With a diagram, explain the construction and operation of a searchhight. (b) Show how it may give a
parallel or a divergent beam.

7. (a) Briefly describe the considerations involved in stepping down the voltage of an electric current. (b Explain by a diagram how you would proceed to make a transformer for stepping down 110 volts.

8. (a) What are the forces which a grand-stand designer should take into consideration for the welfare of the public? (b) To what extent should a contractor most these factors?

9. (a) Describe a freezer. (b) Why does meeting ice freeze cream? Why is salt used?

10. What impressed you in "Fighting a Fire with Brains"? (b) What principle is involved?

from the rade and travels along gas-pipes in the vicinity. If the soil around the gas-pipes is slightly acid, electrolysis takes place and the metal pipe is decomposed

and, unless the current is arrested, destroyed. One way to prevent or to lacarthe electrolytic destruction of the p per is to use negative feeders, i. r., regular conductors to carry the return elecuit to the powerhouse. This can be accompitched well by using two overhead wires of different polarity—the current entering the car or locomotive by one and returning by the other. Another way to lessen electrolysis is by binding the rule together thus making them better conductors. The first meth od in the best, although the most expensive.

For electrotyping, an impression of the type stready set is made in plaster of parisor wax. When the plaster of paris impression has hardened, it is sprinkled over with powdered graphite, so as to make the aurtnes a conductor. After suitably attaching a large copper wire to make connection with the graph to surface, the back and edges of the paster of paris impression is covered with wax, If any graphite is on it there. Then the plate is hung in a solution of copper sulphate as the cathods of an electrolytic cell. A copper plate is used for the anode. A current of large amperage is then sent through the cell. The copper ions are deposited on the plaster of paris blocks and become copper stoms, making up a copper coating. When the coating is thick enough, the electrolysis is stopped and the plaster of paris removed from the

The copper plate than has the same impressions as the original type and is known as an electrotype.







J B. McConnell, Jr Keene, Tex. Age 19

R. L. Rrummel G. E. Happell Kansas City, Mo. Age 16 Saegertown, Pa. Age 17

Question 5. HENRY J. MACMILLAN, Central High School, Syracuse, New York.

Take an old battery apart, saving the carbon rod and the mixture of MnO, and graphite. Set the latter saids to dry. Take a cardboard tube about the diameter and length of a dry-cell and line it with several layers of tinfoil. Let the tinfoil come not quite to the top of the tube. Take a sheet of blotting-paper and cut it so it will fit inside the tinfoil. Allow enough so that it will extend an inch over each end of the foil. Be sure that it is large enough to cover the foil without leaving any part hare. Cut some disks of blotting-paper the same diameter so the cell. Place them in the bottom of the tube and fold the blotting-paper lining over them. Then place another one on top of them. Be sure all the toil in covered. Now take the mixture of manganese dioxide and graphite, and heat

> it, being careful not to let it get red hot, or over 400°. This is to re-exident the manganess dioxide. Stir it all the while It is heating While it cools, make a saturated solution of sal ammoniae and thoroughly wet the inside of the cell, f. r., the blotting-paper. This should take twenty minutes. It is important that the paper be theroughly wet Now take the mixture mentioned above and, using the anturated solution of and smrnonine, make a paste such that a ball of it will stick together. Heat the carbon rod to remove impurities which may be on

it, and place some of the mixture in the hottom of the cell before putting the rod in. Then place it, and push the paste in tightly around it, until the paste is to the level of

the top of the foil. Insert several more disks of biottang-paper, pour in about a half inch of melted paraffin, make connections from the carbon rod and tinfoil bining, and the cell is ready for use. Use it as you would any other dry-cell.

Everett Carman

Washington, D C. Age 16

Question 6. A. DEXTER BEST, Adelphi Academy, Brooklyn, New York.

Although mirrors may be made so nearly perfect that we cannot detect any error, the searchight will never throw a parallel beam of light because the source of illumination can never be a

point. It must have area and therefore must make an angle with the mirror and the rays. instead of being parallel, diverge at this angle. This fact limits the range of searchlights, for otherwise the only advantage of a large searchlight would be in area liluminated. But the fact remains that to decrease the angle of divergence, the arc lights are placed farther away from the mirror, necessitating larger mirrors. The modern searchlight consists of a large parabolic mirror (some are five feet in diameter), a self-feeding are light placed at the focus, a suitable body, cooling arrangements, and a glass front. Some of them have a focusing device enabling them to throw anything from a very wide angle beam to one nearly paral e., and very large once have electric devices so that they may be controlled from a distance. Besides this, those for use on hoats have a disphragm and a shutter so that the size of the beam may be controlled and the light completely shut off without etopping the are,

The focusing device is merely one to change the distance from the arc light to the mirror for if the arc is not at the focus the rays diverge, and the greater the displacement of the light from the focus, the greater the angle of divergence of the light

LH 3,

Question 7. ROBERT PEARY, Western High School, Washington, D. C.

In stepping down a voltage, first and foremost, you must have alternating current. Then there must be a primary winding into which the original current is sent and a secondary winding in which the new current is induced. In the case of stepping down a voltage, the primary contains more turns of wire than the secondary.

First voltage is to second voltage as the number of turns in primary is to number of turns in secondary. An Iron core collects and concentrates the lines of force.

> The core is made of some fairly heavy fron wire, heated to take out its ternper, and shellacked to reduca addy-currents. Around this is first wound the primary, enough turns of wire to furnish adequate resistance, also beavy enough to carry the emperes required. Nest (after thoroughly insulating) the secondary is wound on, the number of turns being governed by the equation in s. For a fixed voltage, this is all that is necessary, but to vary this, caps must be taken off the secondary at different noints. Continued on page 90.



Meurice V. King, Jr. Cleveland, O. Age 17





Getting the Wrinkles Out of Toilet Soap

SWEET smelling soap and shughter-houses are closely all ed In fact, soap-making is part of the mest-packing industry. The picture shows the method of soap-milling used in one of our large packing-houses.

The soup—consisting of fats, vegetable oils, and caustic—is boiled hardened on a chiled grante roller, and dried on acreeus. The resulting snow-white chips are scented and then in iled.

between two granite rollers until they come out in smooth ribbon form.

A busful of soap ribbons is shown herewith. An inspector is exam ning them to see whether they are sufficiently amount. This is but a small item of the process that turns grease into soap.

an ha

A Giant from Holland

I wour land there is a man of most gigantic dae. But be did his growing in Holland, his native country.

This man measures eight feet, five inches. He wears a size usee and a half hat, a thirteen shoe, and a fourteen give! It takes six yards of cloth to make him a suit. Johann Van Albert in his name, and you may expect to see it on hillboards before very long, along he is going to join a circus.

What causes giants and cwarfs? Recent experiments have shown that the thyroid giand controls growth to a large extent. Young tadpoles have been made to grow to monstrous size by operations on their thyroid glands. Whatever the cause of Mr. Van Albert's height, ha is restainly much looked up to in the world.

This Balloon-Man Has a Nose for Business

TOY palloons on attings are such a common night that the usual balloon-needer does not attract much attention. But there is one balloon-merchant in London who always has a crowd around him.

Why? Because he fills your balloon for you out of a compressed air tank while you want. He holds the tiny rul-list bag over the mouth of the air-tank and lets the air shoot in for a

second or two. By the time he has a string tied around the opening, a buyer is waiting to take it from him.

Enterprise in business, if not elsewhere, trianlly receives quick recognition, so use your ingentity to improve your business.



Serve Punch without Spilling It

WATER seeks its own level, and so does punch. The punch-server shown above is a glass bottle with an opening in the bottom as well as at the top. You lower it into the punch-bowl, and the punch flows in until the punch within is level with the punch without.

Place your thumb over the top opening and shut off the air-pressure. Remove your thumb when the bottle is above a glass and the punch will flow out.



A HIGH shoe is easy to pull on, but not so easy to pull off. That's why this boot-remover was invented.

You place your foot securely is the grouve and grip the handle tightly. When you pull up your foot, the shoe remains behind.

Tight pumps and ties may also be removed this way.

The lady in the picture above belongs to the tightpump class. If she ever removes them, we doubt whether the will put them on again





He Couldn't Lose His Ball of String if He Tried

Tille I, e' are the second of the none way to the up 'packages' with string. A man is a large Chicago department-store has found a very good way of keeping the string at hand

He probably thought of the idea when he saw his nister using a crochet-ball

holder on her wrist

'Why not use this method in the store tying the undless packages that I handle every day?' he questioned.

After he made the error

After he made the experiment, he decided to keep the string on his wrist, where it would accompany him wherever his duties carried him

People now carry watches and memorendum pads on their wrists. Why not carry a ball of twine? Forgetful people would be saved much trouble if they would keep the articles that they constantly use attached to their person

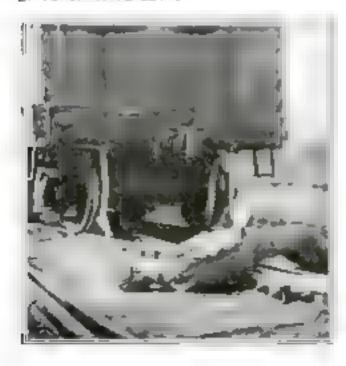
Wheel-Guards that Save Life

PEOPLE cannot be killed by freight-care
if the care are equipped with wheelguards I ke those shown in the picture.

As the car comes along, the guards hang in a horizontal position at the end of arms just above the tracks. But as soon as they come in contact with a body, counter-halances cause them to drop so that they touch the tracks. They automatically throw the body aside—and the car continues on its way. The man gate up, brushes off his clothes, and decides his hour has not yet struck.

The inventor of this guard, Adam Cantion, once saw a fellow railway worker killed, and was not content until he had succeeded in inventing the safe.

guard described above.





Working Safely on High-Voltage Lines

YOU can touch a high-voltage wire in safety if you are standing on a non-conductor, such as dry wood. That's why the small wooden platform shows above was built.

The workmen standing on it must make repairs in the midst of wires carrying as high as seventy-five thousand volts. The platform is made of specially treated wood and it can be adjusted to any height on the pole. Should the workman touch a high-voltage wire, the current would be grounded

Trapping Waspe in a Glass

A FLOWER-POT, a jelly-glass, a sawrer, and three small wooden blocks make a spiendid wasp-trap. The saucer filled with sweetened water, is placed on the table. The flower-pot, inverted, resin on the wooden blocks and partially covers the saucer. The jelly-glass, also inverted stands on the flower-pot

Along comes the wasp. He drinks the sweetened water, fless upward, and is trapped in the flower-pot. He sees light through the hole in the pot, and crawls through into the jelly-glass.

By thrusting a sheet of paper between the glass and the pot, you prevent his meaps when you remove the glass.





CARBON paper treated with heat brings it back to a useful man-

Two shorts of when care or his or troplant, figs to fair to fair as but tour art represent to the unit of the tro-

The sheets are then placed on a flat surface and covered with a piece of this paper. They are then fromed out with a but flation and pulled spart before they become cool.

Renewed in the manner described, carbon paper will give considerable service before it becomes necessary to relegate it to the waste-basket.

The temperature of the fintiren must not be too high or the paper will be

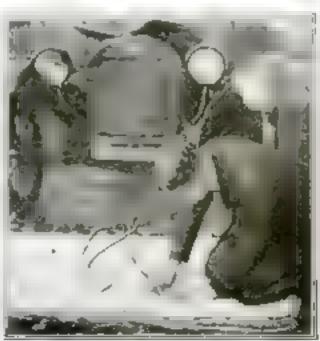
If one attempts to pull the paper spart before it has cooled sufficiently, it will tear

The Air-Hose Cleans House

If you have an air-pump on your car, driven from the engine, you will find it useful for many thirgs besides fiat tires, it will clean mattresses and upholatered furniture just as effectively as a vacuum cleaner, though its action is entirely different

Instead of sucking in the dirt, the hose of the air-pump blows the dirt off. However, since it is used out of doors, the flying dust does no harm

The air-hose can be used also for spraying paint. The notate is placed inside a can containing paint, and the force of the air causes the paint to issue forth in the form of a spray. This method of painting saves a great deal of time.





A Lake that Has a Crust of Salt

GOING through the weird region of Death Valley, in Cohfornia, travelers looking from their perch upon a hill e where a wide view is commanded, may see what appears to be a last of ice gleaning in the authorit

When the lake is reached, one finds it to be not of ice, but that it has a crust of say. The suclaces of these lakes are wet in winter and dry in summer, where dramage from surrounding highlands pours upon them the flood of winter raise. Evaporation is rapid in this region, and by the time the dry season begins many of the lakes have become crusted with hard sait

In spite of this abundance, it is eard that Europeans introduced the use of sait to the United States.

Buy from the Silent Salesman

"STATIONERY" reads a sign on top of a small cabinet in the lobby of a hotel or in a store. It tests you where to get paper and stumped envelopes

The cabinet is a silent salesman, ever at the service of the one who would buy stationery. When you go in and ask for an envelope, the clerk points to the corner of the room and says, "There's the cabinet help yourself"

A plain box arranged to hold the needed stationery works automatically, and furnishes a stamped envelope and writingnature.



Screw-Nuts Tame Horses

A FARMER in Oakland, Oregon, had several borses that defied all barriers and wandered into his or his neighbors' wheat crops

One day, he found a large rusty nut, about two inches square. He looped a string through the nut and tled it to one of the horse's forelocks. The horse ducked its head when released; the nut gave him a whack above the eyes. He trotted staidly, the nut remained still

Now all the horses have large nuts tied to their forelocks, and they behave as well-mannered horses should.

Is There Paper in Your Shoes instead of Leather?

THE shoe below looked like an allleather one, but when it was ripped open, paper was found in several places. When you wish to test a pair of shoes, press a pointed knife against the leather. If it sinks in easily, you'll know that there's paper present. "Unfortunately, very few dealers will permit you to make such a test of their merchandise.

By substituting paper for leather wherever possible, a manufacturer of cheap shoes is able to use a better quality of leather in the parts that are most subject to wear

Paper is widely used for the upper layers of the beel. The bottom layers are nearly always leather, to give better west

Measuring the Amount of Evaporating Moisture

IT is necessary for the farmer to know how rapidly the moisture in his part of the country evaporates. And he is able to find this out by taking an evaporometer, at C. G. Bates, of the United States Forest Service, has recent y invented one, and it is shown abo.

It consists of a small seamlon metal tank seven inches high—to which a wick is attuched

The tank is filled with water which excepts through the wick and subsequently evaporates. An indicator on the tank shows just how rapidly the water disappears.

The amount of evaporation is due to several causes, chief of which are, of course, wind, sun, and temperature.

A Stathoscope for Telephones

"PLEASE speak louder. I sannot hear

it will no longer be necessary to strain your hearing over the phone. This new sound-ampufer makes it possible to hear long-distance calls in a noisy foom with perfect case.

The device is not electrical. It operates on the principle of the physician's stathoscope.

Place the telephone receiver on the pneumatic receiver, with the two rubber tubes leading from it placed in the care. Even the faintest sounds will be heard.





Taking the Drip Out of the Candle

CANDLES, though cheep, should not be wasted. And the best way to prevent waste is to prevent dripping. Here is a new dripless candle-holder.

A metal cap fits over the wick end of the candle and keeps the melted was from running down the side. In fact, a small pool of wax collects in the cap, feeding the wick as long as the wick will burn

The cap slides up and down on a back support, automatically adjusting itself as the candle diminishes.

Bale Sheet-Metal Scrape

BALE your sheet-metal scrape and you will find them easy to dispose of. A small press that will do the job well is shown below

The straps are dumped into a hopper at the end of the machine, and when it is full, the lid is closed down. Next, the press is set in motion by a crank-lever and in ten accords the bale is finished!

The press is so constructed that it exerts pressure on four sides at once, causing the acraps to cling together.

To guard against damage through overloading the hopper, the press is provided with a cast-iron block that will break if too much strain is placed on the press. Five horsepower is needed to run the press, which weighs thirty-five hundred pounds. It can be mounted on a truck and moved from place to place.



Punching for Votes

VOTE by machinery—that's the latest. Instead of filling out a ballot by hand, you punch a button directly under the name of your candidate.

Your own voting number has already been adjusted on the machine; thus both your number and the name of your candidate are regutered.

The tedium job of counting ballots is eliminated. Will the taxpayer be content to let a machine vote for him?

The Reverse of That Adage About Oil on Troubled Waters

NOW that ships have begun to burn oil instead of coal, the danger of fire in and around harbors has been greatly increased.

Although it is against the law to clean ship tanks and bilges near docks, seamen persent in doing it. At Brooklyn, New York, a thick layer of oil can almost always be seen around the repair yards. As a result, many fires—some of them serious—have broken out there. A lighted eight thrown on the water is enough to start a fire, as the oil floats on the top of the

Put Your Shoes in the Boot-Lock

C. Spiermarkeren etter die

If you leave your dusty shees andede of your door when you stay at a hotel, you may find them shound by the morning light or you may never see them

again; the chances are about even.

But there is now a new boot-lock that can be attached at the side of a door. You put your shoes in it, and only the hotel valet knows the combination.

Shoes are too valuable nowadays to be treated lightly, and the new hoot-locker will case the minds of hotel inhabitants

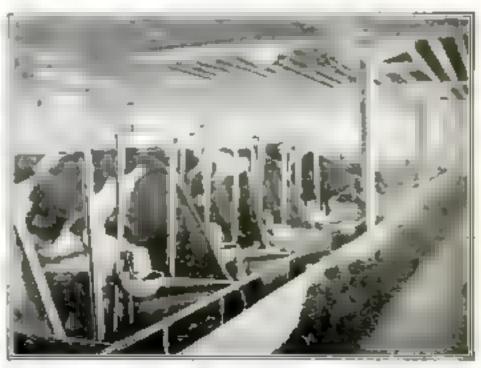
Drinking-Cups for Cows

UP-TO-DATE desires have individual sanitary drinking-cups for cows, instead of the old-style buckets connected with the same supply-pape. If any animal was diseased, the germs would be carried from bowl to bowl.

This new drinking-cup is a small iten basin just large enough for a cew. In the bottom there is an adjustable steel plate.

The water comes from a pipe above the rim of the bowl; thus no germ can float back into the supply system. A valve steeps the water from constantly flowing into the bowl. When she is thirsty the cow puts her nose into the bowl and pressure down the steel plate. This pressure opens the valve and the water runs into the bowl. The water will run in as fast so the cow can drink it



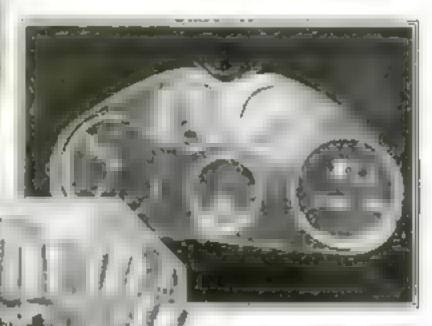


What's New in the Economy is the watchword of



The desert service station at Ya. a. Arrono ser a their same hopping to a to diag to count of the sport





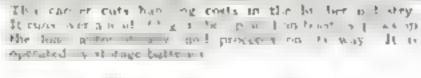
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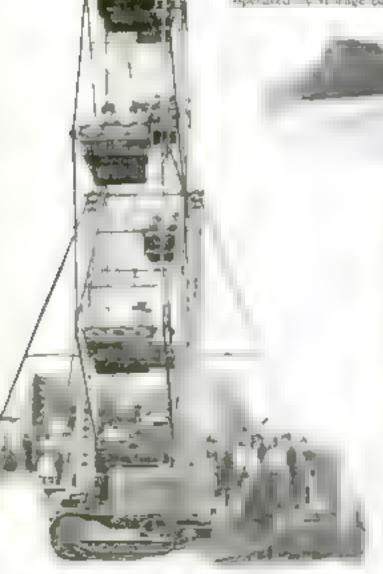
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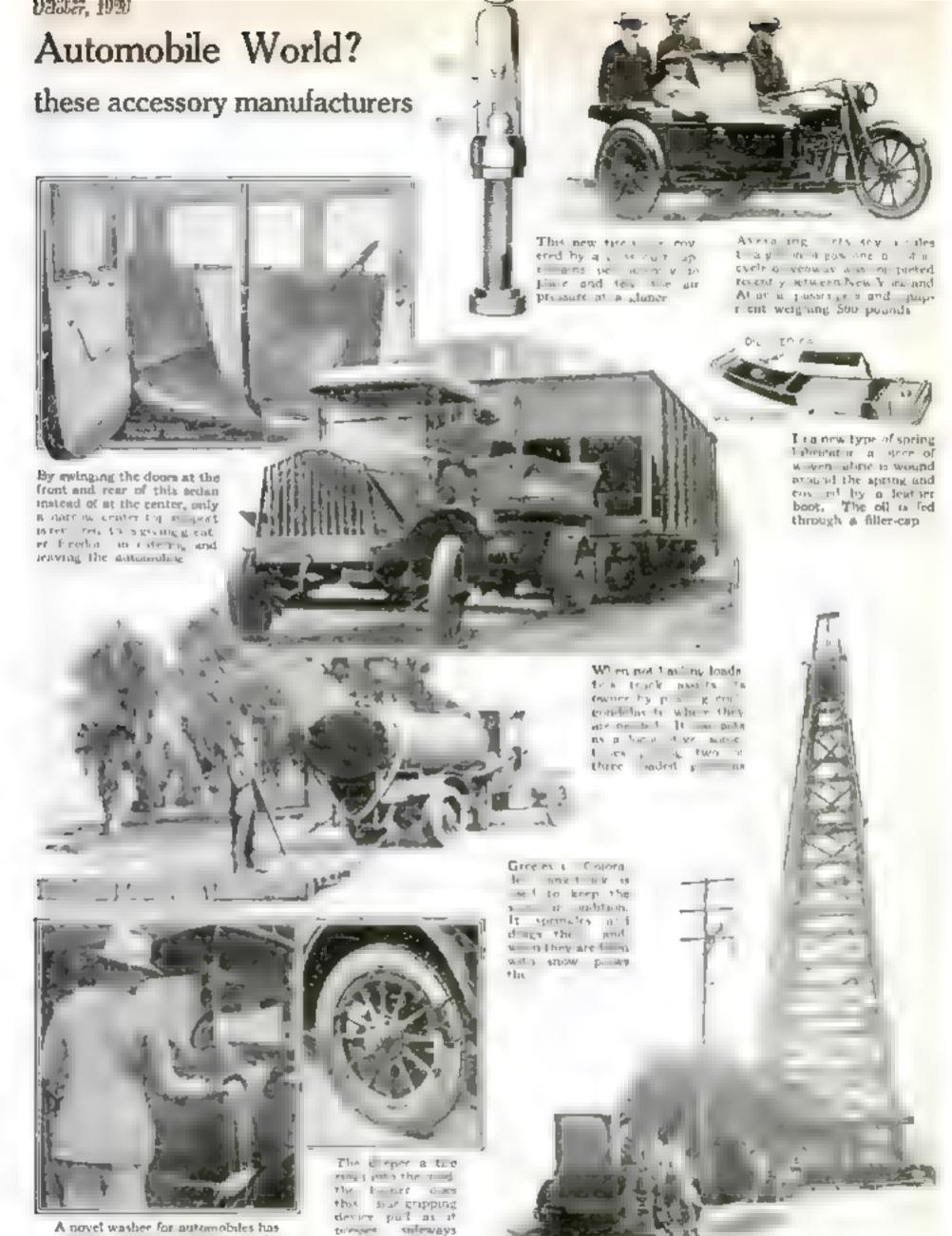
At the Wyoming State Pair at Cheyenne a Ferris wheel was run for a week by belting up a small track-laying tractor of the kind used on farms



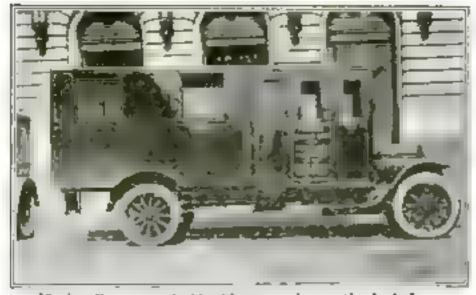
the property of the state of th tions to prevent it from functioning

W , 1 10 81 creating A new vacuum cleaner operates from the automobile's exhaust, and embodies the vacuum bowl, hose, and brush succle

4 B



a hot ow handle attachable to the garden hose. The water cushes out through the revolving brush and with the continuous flow cleanaes without scratching at the coming min prominence almost as fast as the oil-wells.



No bandit can get inside this armored car; the body is of steel, with a layer of asbestos

Your Money Is Safe in the Bank Tank

THE Cleveland Federal Reserve Bank has put into service the "vault on wheels" shown in the picture.

It is an armored truck having two compartments. One, in which the driver and chief of guards ride, has no bars. The second compartment in which the cash is carried, will carry as many as eight guards. Folding seats extend along the sides as in the ordinary patrol-wagon. Gun-racks, dome lights, and speaking-tubes complete the appointments.

The entire body is encased in a bullet-proof conting consisting of an outer and an inner layer of heavy steel having a layer of asbestos between. This armor cannot be paretrated by a platel projectile of

the highest caliber.

Taking Out the Bumps

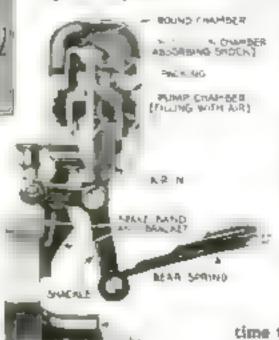
WHILE the pneumatic shock-absorber for Ford cars is more expensive than devices of the spring or lever type, this is more than offset by its better riding qualities.

As shown in the cross-sectional view, the apparatus is made up of a compound cylinder composed of three separate cylinders. The first is a pump-cylinder from

which the air sucked in on the down stroke of the piston is forced into a compression-chamber to absorb the shock. Once the shock has been absorbed, the pressure of the air in the compression-chamber is relieved to permit the rebound chamber, at the extreme top, to absorb the shock of the rebound.

The piston-rod of the lowest chamber is attached to the regular Ford shackle as used on the front and rear springs. As this piston-pump is set in motion each

time the end of the spring moves up or down, it sets up an air-pressure in the other two cylinders, which is automatically maintained by the up-and-down movement of the car when it passes bumps. Each absorber works independently, so that the varying intensity of the shocks is taken up by each absorber individually.



For the Ford comes this new type of shock absorber, which is made up of a compound cylinder embodying three separate cylinders. Although it is more expensive than the spring or lever type, this is affect by its better quality

The Tractor in the Lumber-Yard

IN the present state of high prices of horses and mules, many lumberyards and sawmills are turning to the small gasoline tractor.

Owing to the special tasks to be performed, not every small gasoline tractor will give good results. Some do not secure sufficient traction in rainy weather; others do not have sufficient pulling power; and still others cannot turn in a small enough radius to permit of quick work in the narrow lanes between the lumber-piles.

The tractor shown in the accompanying illustrations is the invention of two lumbermen, S. K. Prescott and H. A. Thurlow, of Seattle. They

claim that the tractor will do the work of from three to seven horses and mules, at a cost less than that for one horse or mule.

The machine can perform many kinds of work. It can pull twowheeled lumber buggies, three-wheeled lumber buggies, or four-wheeled wagons, move small timbers with a grab-hook; push lumber buggies and other loads, pull heavy timbers; and spot railroad-cars. While the tractor is not in any sense a rebuilt automobile, it is fitted with a Ford engine, which is no geared through a sprocket-and-chain drive that it delivers between fifty and sixty horsepower to the rear wheels. This power is delivered eleven inches off the ground, giving the machine an exceptionally strong drawbar pull. The Ford motor has been found particularly well adapted for lumber-yard hauling because of the foot gear-shifting mechanism, which enables the driver to get under way with a load very quickly.

A truck type of radiator with double the cooling capacity of the Ford pas-



Equipped with a Ford motor, this baby tractor is so genred that it delivers sixty borsepower to the rear wheels

senger-car type is fitted to prevent the engine from overheating under

eteady pulls. A guard in front of the radiator permits loads to be pushed as well as pulled. At the rear of the tractor is fitted a special swivel-bar with a wire rope and winch to support and regulate the front end of the load when carried on a two-wheeled dolly.

With its small but powerful engine the tractor is adaptable to a great variety of work easily serving other than lumber manufacturers.

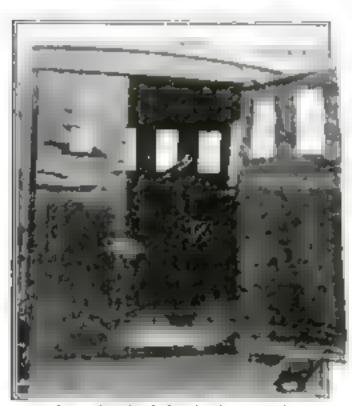


The machine performs many kinds of work in the lumber yard, it is not a rebuilt automobile, and it does seven horses' work

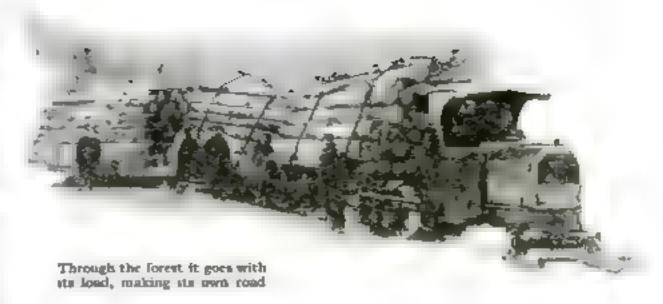
Protecting the Driver from the Elements

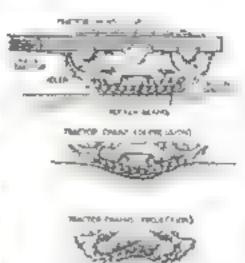
TENDENCY in abroad today A toward the greater use of closed cabs on motor-trucks in order to protect the driver in rainy or enowy weather. Most of the completely enclosed truck cabs, however, are fitted with door units, which must be removed in hot weather. Sometimes they become misland or damaged

To overcome any need for storing the doors away when taken off, an Eastern truck-maker has devised a removable cab door made of leather. which can be folded like the side curtains of an automobile and placed under the driver's seat,



An enclosed cab for the driver made possible with detachable door units





In this flexible tracklayer the cleats follow the curvature of the ground touching it at all points and giving a greater traction when most peeded L c, pressions

A Flexible Track-Layer

HE track-laying wheel shown in the ac-L companying illustrationals different from all other types of similar devices in that the tread is flexible and follows the contour of the ground, instead of being rigid, such as was the type used on the British tanks.

There are certain advantages of the flexible type, especially when applied to a vehicle intended for commercial hauling, such as logging work, pulp, and chamical wood haulage, and the like. With the rigid type of track-layer, the tread must span a depression in the ground or crush a projection. When it spans a depression almost equal to the length of the tread itself, the track-layers only touch the ground at each end, thus reducing the amount of traction by decreasing the area of tread.

With the flexible type, however, the cleats when passing over de follow the curvature of the ground and touch it at all points, so that the traction is greater when passing over a depression than when traveling

on level ground.

An Underground Gasoline Storage-Tank

TOUT-PUT your engine gasps and then dies. You waste an hour going over the engine, the ignition sys-

tum, and then decide that it must be dirt in the gusoline feed-pipe. You spend the rest of the day under the car.

Clean, fi.tered gasoline is absolutely essentise to the good running order of your car If you have a garage of your own, build an underground gasoline storagetank near it and keep your own gasoline suppay You can fater and drain it yourself.

An excesent atoragetank is shown herewith It is located in a small concrete cellar and reccives its supply of gasoline through a pipe that terminates aboveground.

The pipe has a strainer attachment. that may have got into the gasoline. There is a drain-pipe at the bottom of the tank that carries off any sediment

When wishing to draw a supply of gasaline from this underground tank, pump air into it and the gasoline is forced out

There are two more pipes attached

to the tank an air-inlet pipe and a gaspline - outlet Both of them lead to the garage. When you wish to draw up some gasoline you connect the airinlet pipe with a tirepump and send a supply of air into the tank This will force the gasoline anto the outlet pipe and it will soon be flowing into the tank of your automobile.

> An underground storage-tank has several advantages over a tank built aboveground. For examp e, it is free from dust, dirt, and rain, and there is decidedly less risk of explosion, to say nothing of the additional floor space.

Providing an Ocean Liner with Listening Ears

AN ocean liner is coming close to port and a dense fog blankets the sea; yet the engine is running at a scarcely noticeable reduced speed.

"What a reckless pilot!" might be your thought, But if you stepped into the cabin where the navigating officer is listening to what the telephone receivers have to say, a remarkable condition in disclosed. Not only every vessel within a radius of about fifty miles whose propellers are working, but every lighthouse signal station or bell buoy, can be heard. From the direction of the sound and its intensity, the inbound steamer

can be safely steered through the fog. Not only that, but the depth of water in which it is moving can be gaged, provided the water is not more than one hundred fathoms deep. "How is this wonderful result accomplished?" asks the uninitiated.

Installed on a ship the hydrophone



The captain of the Breckinside and H C Hayes, one of the inventors, butening in on the hydrophone

indicates the approximate depth of the water, as well as discloses the presence of other craft. It can also be used to communicate with passing aircraft, and is, in all, a wonderfully useful instrument

The hydrophone, as used for sounding the depth of the water, consists of a set of microphones which are placed in a tank in the keel of the vessel, totally submerged.

In the forward part of the vessel, at a known distance from the ship's center, is the registering part of the instrument, consisting of a dial that points out certain angles of a semicircle. Alt is the propeller, the noise of which is reflected from the bottom of the water.

The angle of reflection equals the angle of incidence, in sound as well as in light, and this angle is indicated on the dial

The reflected sound, reaching the microphones, causes the dial to move

with the shifting of the ship's position, as the sound is sent back from the various planes of the sexbettom.

A simple calculation, arrived at from a table, enables the navigator to chart the region over which the vessel is passing.

The One-Man Submarine Is Here

Hornet. It is a mere apeck, barely visible, like a small raft latch controlled from moving at great speed, showing only tower, thus admitting six inches of surface above the water.

The Hornet is a one-man submarine the torpedo is started which travels at a speed of 30 knots missile is directed to the directed to the species of the same appearance with the same is alone.

The Horner is a one-man submarine which travels at a speed of 30 knots and carries a torpedo charged with from 300 to 500 pounds of T N T. The length of the submersible is 40 feet and

Its weight is 3500 pounds. The crew consists of one man. He pilots the craft and directs and fires the torpedo.

UT from the fleet darts the Neg

In firing, the gate at the bow is raised by means of a latch controlled from the conningtower, thus admitting the water to the torpedo-chamber. The mechanism of the torpedo is started and the deadly missile is directed upon its course. Then the gate is closed and a powerful pump operated to remove the water from the compartment. Just forty-five to get the submarine ready to speed up its (200 horsepower At 30 knots

an hour it swings back to the protection of the fleet to receive a new charge

This interesting invention was designed by W. B. Shearer. The mininture submarine can travel on the surface, and from its size might be mustaken for a motor-boat. Submerged,

its forward deck is entirely concealed and barely as inches of the rear portion of the boat projects above the water.

Only from the air would it be easy to detect the Sca Hornet going on her "lawful occasions."



When she is submerged, the forward deck of the mineture submarine is entirely concested and barely six inches of the rear portion of the bost pre-ects above the water

The one-man submarine is scarcely larger than a motor boat It is a trim little craft above the water with a speed of thirty knots an hone The gate in the bow of the submarine opens, the torpedo shoots out and the gate clases. A powerful pumpejects the water that entered the torpedo-chamber



Imitating Rain, Thunder, and Snow for Amateur Theatricals

By Lawrence B. Robbins

This machine imitates wind and rain,

there is nothing complicated about it

Many effects simulating nature on the stage are made by the orchestra, but there are a few that call for special appliances. On the professional stage these are somewhat complicated, but for the wants of the amateur actor the machines berein described will give those affects very realistically and will be found simple to construct. Much of the naturalness of certain scenes can be realised by their use and the continuity of the entire play improved.

Figure 1 represents a machine for reproducing both wind and rain, either singly or in combination. It consists of two revolving drums mounted upon a frame of heavy timbers. Four triangular sections of the frame are first built of 2 by 4 spruces after the pattern shown in

detail. The axie-bearing should be about 36
in, from the floor. Bost
the peaks together and
brace the under part
with an angle iron.
Leave the bottom or
base open until ascombled upon the base
timbers.

For the wind effect build a slatted drum 18 in, in diameter and 24 in, long. This is constructed of two circular data of heavy wood. Then nall slats around their circum-

ferences, completely enclosing them. Leave about one inch between the slate, and sandpaper them off smooth so no splinters will show themselves. Bolt a pipe flange in the exact center of each disk and thread in a piece of 1½ in, piping for an axle. These two pieces of pipe must be in line so as to make a true running axle. Slip a couple of washers on each end. Then construct a crank for one axle with elbows and short lengths of pipe as shown. The extreme end of the other axle should be heated to redness and pounded into a rectangle (square).

The rain drum is composed of a circular hox similar to that shown. Nail metal lathing around the entire inside or drive in small wire nails. Put in about a pint of dried peas or old shoe buttons. Arrange pipe axles on this drum the same as on the other. These axles should be somewhat longer than the others. A crank is constructed for one end similar to the one for the wind drum and a square wooden plug driven into the open end of the opposite axle. Make it of hard

wood and of a size to fit in the squared end of the wind-drum axle. Secure it with a set screw. Set a spiral apring over this end of the axle with a pair of washers and two washers over the crank end.

Now set the axles of each drum in a pair of the frame sections, arranging the washers in the wind drum so there will be no end play to mention. The washers and spring should be placed between the frame section and one disk of the rain drum; the washer on the opposite axle being held in place on the axle at a definite point by a cotterpin. This allows the axle to be pushed along the length of the spring but no further.

Next, build a base of four timbers bolted together and arrange the poatton of the four section frames in the

> relation indicated. Set the rain drum just far enough away so that the spring holds it from engaging with the axle of the wind drum, but will engage with it if the axle is pushed in. Throw a sheet of milk over the wand drum and secure It to the base at one end with light springs as shown. Hang a weight on the other. Thread on the cranks and secure with set screws. By turning

the cranks of either drum separately you will get the effect of whistling wind or beating rain and by engaging the two axies and turning both at once the combination of both is produced together. Nail a brace each side of the frames and the machine is done.

This is accomplished by suspending a sheet of iron vertically, clear of obstructions, and shaking gently or hard according to the intensity of sound desired. Rivet a wooden cleat to one end and attach a rope to hang it by. A looped rope in the lower end will serve to vibrate it. A sheet the dimensions given will give a good imitation of thunder.

If the storm occurs in winter and snow is supposed to fall, the following will give the



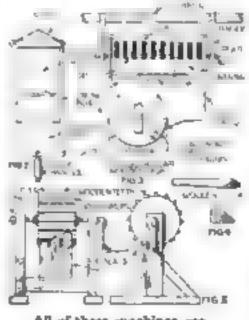
semicircular pieces of wood and connect them with a covering of sheet iron, cardboard, or stiff roofing paper. Set in a couple of ribs to give shape to the middle of it. Then cut a row of slots 6 in. long fairly close to each edge. Make them 1 in, wide and as far apart. Pivot the top of each end of this container through a piece of wood and nail these hangers to an overhead beam behind a border scene. By partly filling this with fine white paper and rocking back and forth by pulling on the pull cords attached to each end, the paper will sift through the slots and fall to the floor as desired Suspend this arrangement at one

Suspend this arrangement at one end of the stage and set an electric fan beyond it and the wind can be made to blow it by a window or open door as though driven by a gale. Operating the wind machine with it will aid to the illusion

A policemen's rattle is a good example of the idea used in imitating falling or splitting timbers. Saw off a section of round log about 15 in. in diameter and set axles on each face as previously described for the wind and rain machine. Then serew hard wood teeth around its circumference at right angles to the sides. Make of hard wood and with a cross-section as shown in detail. Build a frame of

2 by 4 timber as illustrated in Fig. 5 and mount the axles in holes for bearings in the uprights. A cutter-pin in one end of the axle will prevent it from pulling out the bearing. Make a crank of pipe-fittings for the opposite end.

Three strips of oak 4 in. wide and 1/4 in. thick, and long enough to strike three sepa rate teeth of the drum when arranged as shown under the drum, will furnish the clatter



All of these machines are operated by a handle

An Out-of-the-Way Clothes-Rack

Out of the way when you don't need it, but ready for instant use

PERHAPS one of the most useful household articles I ever turned out with my own hands is the adjustable, collapsible, and out-of-the-way clothes-rock.

"A common, ordinary clothes-rack," you will say. "Anybody can string a clothesline across the kitchen for service when the rain is pouring down." Yet this clothes-rack accommodates a large washing, and once the wet clothes are on the rack, the whole rack is pushed up into the hot air next to the ceiling and the clothes are entirely out of the way.

Nine 4-ft. sticks, preferably of seasoned sah, each 1/2 by 1/2 in., highly sandpapered to a very smooth surface and the sharp edges rounded off

are the first requirements.

Drill a light. hole light, from one end of each stick in the center of the light, side, and with a large flat-sided has pround off the end. See Fig. 1. These pieces are the clothes arms and are riveted to a movable support.

From a 3-ft, piece of oak, 114 by 3n in., cut two pieces as shown in Fig. 2. A 1/2-in. drill-bole 1/4 in. from each end furnishes a clearance hole for the wood-fastening screw so that it will not crack the wood. Six inches apart, 2 in. from the center line are two ¼-in, holes drilled only 🦂 in. deep, while directly on the center Une, but in only one of the pieces, is a 34-in, hole all the way through. Two strips of wood 🎢 in. square by 30 in, long, and two bram reds each 1/4 in, by \$1 in, long, separate the two sticks shown in Fig. 2 and form a framework of the stationary part which is fastened to the wall. See Fig. 3.

It must be understood, however, that before this framework can be

completely assembled and fastened to the wall, the movable part must be placed on the rods.

This movable part is composed of eight pieces of wood and is shown in Fig. 4. Port I is a piece of \$a-in. nak S in, long and 3 in. wide. To the ends of this piece are securely nasied two 9-in, strips 🦮 by 🔏 in., allowing 1 in. to extend beyond one side of the strip (Part I) and 5 in. on the other side. These strips are marked Part H and

By Theron P. Foote

Part III in Fig. 4. One half inch from each end of the strips drill a 1/2-in. hole the rest of the way through. Part IV is a hard piece of oak 71/2 in. long, 13/2 in. wide by 3/2 in. thick, having 3/2-in. holes all the way through, the holes being 6 in. apart. If the center line of



When open, the clothes-rack accommodates a surprising number of clothes

these holes is % in. from the back side of the block, this will allow a clearance of 1/2 in. between Part IV which slides up and down on the brass rods and the wall on which the standard is mounted. (Note in Fig. 2, that the 1/2-in. holes are 3/2 in. from the back side of the strip. A 3/2-in. hole is drilled in the center from the back and is only 3/2 in. deep. Parts V and VI are two 14-in. pieces of oak 3/2 by 3/2 in., having 1/2-in. clearance holes drilled on the 3/2-in. side in the ends. Parts VII and VIII are 7-in. piecess of 1/2-in. round rod.

After assembling these eight please, the ends of the clothes arms having the lig-in, holes, and as shown in Fig. 1, should be placed on Part I of Fig. 4 and spaced to form a V. This will allow a free movement of all rods when open, while when the rack is closed the rods will fit closely together.

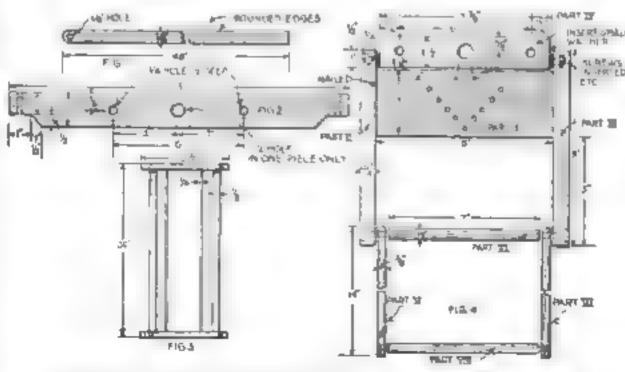
One-eighth-inch iron rivets, 2 in. long and having suitable iron washers to fit, fasten the clothes arms to their base. (Part I, Fig. 4.) In riveting, first place a washer on the rivet next to the head, then the rivet through a clother arm, then another washer, then through the base, then another washer. Inverting the whole thing and placing the rivet head on a metal foundation, hammer over the end, This operation must be done with each clother arm, and when the nine clother arms are securely riveted on the movwhile support, the whole is placed on the brase rods of the wall support. One end of a 14-in, round rod 36 in. long is glued and nailed in the 59-in. hole Cáin, deep in Part I of the movable part) and protrudes through the 15-in, hale in the battom piece of the standard. By means of this rod the movable section is pushed upward on the rods. A small piece of brase wire bent so as to spring into the position shown in Fig. 6 is sufficient to hold all the weight one could place on the rack without breaking it. In letting the rack down from the ceiling, simply press in the spring wire catch and the rod (having the movable parts attached) will slide easily through the }4-in, hole in the bottom support.

When amerabled on the wall, raise the clother arms to a horizontal position, swing in Part VIII, Fig. 4, until it comes in contact with the ly-intround rod used for raising, and drilling a small hole so as not to crack the rod, place a acrew-aye for this round rod to brace against, thus maintaining

the clother in a horizontal position.

Do not attempt to shellar, varnish, stain, or paint the rack, as the wet clothes would be a poiled. The crudeness of appearance may be improved by using fine sandpaper.

As wash day usually in rainy, your wife or laundress will appreciate your making this rack. If it is rainy or cold outside, it makes no difference, because she can do the wash on schedule and hang the ciothes to dry inside.



All parts of the clothes-rack are clearly shown, together with their proper dimensions. The rack is made, preferably, of seasoned ash sensionered smooth





Taking the "Sigh" out of cycling

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The book is to serve as a reminder to you that Kokomo Bicycle Tires are about the longest wearing, uniformly good tires built. Their heavy fabric foundations means fewer punctures and longer life.

For a quarter of a century Kokomos have given supreme satisfaction. They never disappoint. Ask for Kokomos, when you need new bicycle tires.

Kokomo Rubber Co.

40 S. Main Street, Kekomo, Indiana

When you want the most satisfactory of all tires, ask for the Kokomo-Everlanter, the tire with the thick, white, enduring tread over a heavy motor-cycle fabric foundation. whose "twin grip" makes the wheel roll easy and is proof sgainet slip or skid.



ICYCLE TIRES



Contributors by Cycle reder Campaign to Pramote Meyeling

Make Your Own Electric Toaster

By Edna Purdy

COR a very small sum an electric toaster can be made at home. Secure a piece of asbeston 6 by 10 in., and 1/2 in. in thickness. Twelve holes are punched in the asbestos, six at each end, to hold electrician's bolts, which in turn hold six strands of electrical heating wire stretched across the asbestos, held straight in the center by running them through six roundeved acrews. The two electrical wires are connected to the two end screws at one end of the asbestos on the under

The essential part or heating element of the toaster is now complete, The remaining operations are mostly a matter of choice, except for the underneath finishing, where one must be careful that no metal touches the two wires where they are attached to the outside screws. A suitable stand may be made of sheet metal held 14 in. below the asbestos by hollow posts covering long screws approximately 114 in. in length.

The top to hold the toust can be



Twelve holes punched in the asbestos to hold the bolts



All points thust be protect ed against short-circuiting



A suitable stand is then made from sheet metal and the heating element attached

Five small metal strips are placed between the ten remaining screws on the under side of the asbeston to complete the contact of all wires giove.

made of heat-proof screening stretched across four straight metal pieces, or heat-proof metal wire may be inserted into the two side metal supports through drilled boles.

Winners of Our \$5000 in Scholarships

(Cantinued from page 77)

Technical High School, Cleveland, Ohio

A grand-stand designer must take into consideration the dead weight of the structure itself, the dead weight of the round force exerted by reaction when dead weight of crowd is put into action in rising or moving and also vibration's effect on material

The community should require the contrartor to make allowance for several times. the strain which could possibly be brought to bear on the structure

Question 9. WILLIAM J. VAN ARD, High School, Yonkers, New York.

A quick-action ice-cream freezer is samply constructed. A pail with a tight cover is used to hold the ingredients. The cover has a circular hole cut in the top and is made so that a smaller pail may be saldered to it, fitting within the larger pail contains both smaller pails and is packed. around the maide with ice.

In melting, the ice absorbs the heat from the mixture of ingredients. Salt is used to lower the freezing-point of the ice and water and thus causes it to melt faster

Question 10. EVERETT P. CARMAN. Central High School, Washington, D. C. What impressed me most was the fact hat the electrician expected the dynamoo stop generating by throwing out the gwitch at the bus bare. It seems strange New York.

Quantion & EDWARD J. VACHUSKA, West that he didn't think of killing the dynamo by throwing out the field switch. I think the helper was a quick chap to catch on so quickly and use in such a time the facts that his chief gave him.

As long as the turbine ran and the electrician did not want that stoppedand so long as there was current in the field coils, the wares of the armsture were entting the lines of force about the field coils and were generaling electricity. It was this current which was areing on the wires in the oil-pit and which was puzzling the bead electrician. As soon as the field switch was opened there were no magnetic knes of force about the field come and the wires of the armsture had no magnetic lines to cut, consequently there was not more current generated.

If for any reason the prize-winner in any Storb se musors to rake statuteds of rue when the cover is on. A still larger bucket scholarship offer, the student receiving the next highest mark in that group will act as alternate. The names of the second highest students follow

> GEORGE MATHEN, Johnson City, Tenn ; JOHN LEWIS, Alexandria, Minn.; SHER-WOOD PAUL, Dailan, Tex.; PHILIP HOL-GREN, Missoula, Mont.; ROGER HACKNEY, Wellington, Kan.; DOUGLAS W. OWEN. South Bend, Ind.; James M. KUUR, Tarboro, N C.; F. EDWARD HANDY, Augusta, Maine; SPENCER MEREDITH, Plainfield, N J.; ALIER DEXTER BEST, Brooklyn,



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Champion Spark Plng Company

Champion Special Play Company of Chatmin, Litabed

DEPENDABLESPARK PLUGS





An Alarm that Rings by Sound

By Windsor Crowell

BUAPTEAGT

MINDERSO DIRECTOR

The Blustration shows

just how the different

parts are wired

-

CATTORY

I T only takes a few simple materials to construct an alarm that will warn the user by a sudden or loud sound operating the mechanism. Such an alarm can be used in various places, such as the sickroom, the nursery, etc., where the noise can warn people in the other part of the house that assistance is needed. There are many other uses to be found for such an idea.

The mechanism is enclosed in a box with a round opening in the front

through which the sound is transmitted to the proper part. Make a box of hard wood about 10 in. h.gh. 5 in. wide and I in. deep. Leave the front open until all the details are installed and adjusted.

Near the top fasten a small block of wood about 1/2 in thick. Then procure a clak of metal amiliar to the diaphragm of a telephone

receiver, 3 in. in diameter, and fasten the top edge to the block with one screw. Set a second acrew into the back of the box directly under the lower edge of the diaphragm and adjust the head so it cleans the diaphragm by just the mercet fraction of an inch.

In the center of the bottom set a magnet. One taken from an old telegraph or electric bell will suffice. A pair of them will do as well as one. Connect the magnet to the disphragm as shown, one terminal to the contact screw under the disphragm, the other terminal to binding-post B. The screw holding disphragm to the block is connected to binding-post A.

The armature consists of a piece of apring brass 1 in, wide, bent at right angles as shown. The long arm is bent at the end in the form of a "trigger." Underneath the metal next the trigger is riveted a piece of soft tron. The short arm of this brass

strip is drilled with two holes by which

CHAPTER CONTROL

EDINTACT LEVER GOT SERVING

ANHARTIES

HAGHET MATTER

ANATER

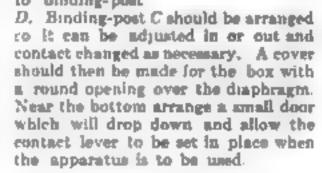
The mechanism is enclosed in a box with a round opening in the front

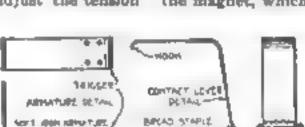
it is fastened to the side of the box. When in position the iron armature should rest about 3/16 in, over the pole of the magnet. The brass should be stiff enough to retain its position, but not too stiff to prevent the magnet pulling it down when electrified

The contact lever is shown in detail and consists of a stiff metal arm bent as shown. The end of the borizontal member is bent down in a book which fits over the trigger of the arma-

ture. Roll up the bottom end over the horizontal shank of a wide staple which is driven into the bottom of the box near the corner. This acts as a pivot for the lever to swing on. Near the angle of the lever drill a small hole into which put a very light spiral spring. Fasten the opposite end of the spring to the side of the box and adjust the tension

so that when the hook slipe off the trigger the lever will be pulled back into good contact with binding-post C. The pivoted and of the lever should be wired to binding-post





The parts necessary to the proper operation of the device are shown herewith



If set in the sickroom, the instrument will warn those in other rooms that the patient is in need of attention

Connect binding-posts A and B to a battery as indicated. Then connect binding-posts C and D to the same battery and a bell with a switch in the line.

The action is as follows: With the contact lever hooked over the armature and the bell switch on, let some one speak or make a sharp sound in front of the opening. The disphragm will vibrate and make contact with the acrew beneath it. This energizes the magnet, which pulls the armature

down to it and releases the contact lever. The spring pulls this back and makes a fixed contact with binding-post C, which in turn rings the meantime the

disphragm has stopped vibrating and the armature returns to its original position.

The bell will ring until the switch is opened and the circuit cut off. The contact lever can then be reset for the next alarm.

This apparatus is simple to construct and will be found to be useful.

How to Break Up Cement Posts

By E. L. Harvey

CEMENT is a mighty tenacious material, as any one who has been obliged to dispose of cement walls, posts, or other structures made of the substance can testify. It is that very tenacity that makes it valuable and so highly appreciated as a building material. Still, occasions arise when it becomes necessary to break up something made of cerrent. That means troube and hard work unless one happens to know how to go about it.

For the benefit of those who may have similar work to do, I want to describe how I disposed of some cement posts which were 5 ft. high, 28 in. wide at the top and 3 ft. wide at the bottom, located inside of a building, and within 50 ft. of 1080 panes of glass. My method was so successful that I didn't break a single pane of this glass. I drilled a hole 6 in. deep about 1 ½ ft.

from the top of each post, another hole 18 in, lower about 10 in, deep, and at the bottom two very shallow holes on opposite sides. In each of these holes, I loaded a third of a cartridge of 40 per cent strength dynamite.

The charges were primed with electric blasting-caps and connected up to a blasting-machine circuit.

Before firing, the posts were covered with old blankets and pieces of buriap, on top of which were laid heavy strips of timber. The shots broke up the posts very nicely. The cost of explosive for each post was about 11 cents for the dynamite and 16 cents for the electric blasting-caps.

I have no doubt that any farmer who has spent the better part of the day breaking up cement structures with a sledge-hammer will be glad to know of this easy way of saving time and labor.

Blue Buckle OverAlls



Like wiping your face with a towel

—exactly expresses the sensation, as well as the perfect ease and comfort of shaving with an Enders Safety Razor.

Enders-Razors-

13 years on the market—2,000,000 enthusiastic users—without advertising—because the production of Enders has never before been able to catch up with the phenomenal demand. Its users, by recommending it to their friends, created a demand for Enders which, until now, we have been unable to catch up with.

This is indeed a case where the satisfied user alone has made a product successful.

"Like Wiping Your Face With A Towel" is more than a phrase—as shaving with an Endern is more than a shave. It means absolute cleanliness and simplicity, two features of The Enders, which appeal instantly—and hold that appeal always.

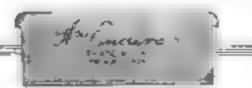
ENDRRS SELLS FOR \$1.00

with my blodes of the best quality Swedish-best tree! Packed in a block Kerstel box, plush listed

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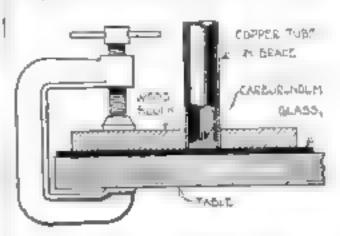
Mrs Enders

ENDERS SALES COMPANY
17 BATTERY PLACE
NEW YORK



The Way to Cut Large Holes in Glass

I T is surprisingly easy to cut large holes in glass. For a drill use a copper tube the size of the hole required, make the end square and true and put it in an ordinary brace. For a cutting medium use a mixture of turpentine and fine carborundum and keep the drill well supplied. Apply



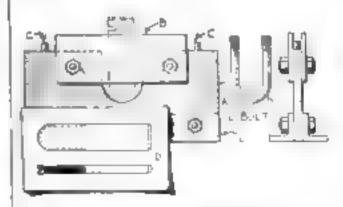
Large holes can be drilled in glass with a copper tube for a drill and carborusdum used as a cutting medium

the earborundum cutting. Go slowly and carefully when nearly through, if you want to make a clean hole. To start the hole in the right place, clamp over the glass a prece of wood with a hole in it just large enough for the tube to pass through. This need be used only until the drill has cut far enough so it will require no further guiding.

Bending U-Bolts with a Homemade Tool

THE illustration shows a tool that was constructed to bend U-bolts which were threaded at both ends and taken hot from the fire.

The body, A, is made from a piece of fist bar steel, a little wider than the U-bolt and was cut out on the top side the desired shape of the formed bolt. Two plates, B, bolted to the



If you have U holts to bend, here is the tool to do it quickly and neatly

sides, and with the pins, C, held the red-hot rod in position, while with the forming bar, D, it was forced into the U shape with a few strokes of a hammer. The forming bar was grooved to fit the bolt.

The two angles, E, were boited at the under side of the flat steel bar, as shown, to hold it in an upright position. With this form the two hundred boits were bent true and all suke in a very short time.— E. S. Goodell.



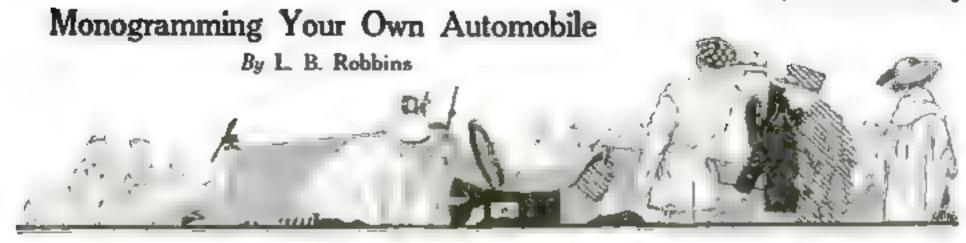
Who Stands Behind your Tires

Out of all the different kinds of tires in the bicycle shop, how is anyone to tell which kind is best? There must be some way of telling—and as good a way as any is to look at the reputation of the companies behind them. The makers of U. S. Bicycle Tires are the oldest and largest rubber manufacturers in the world—and you can invest your last nickel on the fact that there is a reason for it other than merely the number and size of their factories.

U.S. Chain Treads, U.S. Cords and seven other treads in Clincher and Single tube styles.

"Ride a Bucycle"

United States Tires United States ® Rubber Company



A PRIVATE monogram or display of the owner's initials upon the doors of his automobile always adds class and distinction. But it generally is thought that to work out a monogram is the job for an artist or professional painter and is beyond the ability of the amateur. Of course the design may be an impossibility for the owner to create, but with the ald of an artistic friend, the proper arrangement of letters can be accomplished. Then it is only the matter



The paper stencil is laid against the ear and the paint-brush is passed swiftly over it

of applying those letters to the cardoors in the right way.

Now there are several ways to apply designs, but the ensiest and simplest for the amateur is by means of the stencil. It is an easy trick, once you know how, and is worth trying, especially if you can save money and have a good-looking job in the end.

First draw your design upon rough paper until a pleasing arrangement is produced. For the small car I would make the complete height of the design not over 1½ in., but for the large car one can stand a height of 2 in. The width depends upon the nature of the letters and their relation to each other when interwoven, but try and have the design as nearly square as possible.

If a simple row of initials is desired instead of the monogram, it is better to have them somewhat smaller than in the monogram; that is, shorter, my about % in. for the small car to 1% in. for the larger car. All this, of course, must be left entirely to the artistic instinct of yourself or your friend.

With the design completed comes the cutting of the stencil. First transfer the drawing to a piece of heavy, stiff manila paper by means of carbon paper. Lay the drawing over the manila with a piece of carbon between, face down, and trace over the lines of the drawing with a hard-pointed pencil.

Then comes the cutting. This requires great care as it takes a sharp knife and a steady hand. Lay the stencil paper upon a piece of glass, holding two sides down with the left hand. Then cut carefully along the lines of the design with the point of a sharp penknife blade or a regular stencil knife. Whet the blade occasionally so the edge will not chip and drag the edge of the cut, making a ragged tear. Much depends upon a good clean-cut stencil.

Allow Plenty of Margin

As will be noticed in the illustration, each letter is connected to the next with "binders." Their purpose is obvious. All parts that would have no support in the design otherwise should be connected to each other in this manner. Allow plenty of margin to handle the stencil by. If, in the course of continued use, any of these binders becomes broken or toro, it can be mended with court-plaster.

After the design in cut, give the paper one or two coats of sheller or varnish on each side. This renders it impervious to oil or water.

Now determine the exact spot on the car-door that you wish the mono-

gram and, without marring the finish, draw an outline of the design and then rub carefully and smoothly over the varnish with an inkeraser. This will remove the gloss and leave a dull finish but will not cut through to the metal of the door underneath.

To prepare a suitable paint for the stenciling, take a tube of artist's paint of the desired color and squeeze a little out on a blotter so as to absorb all the oil possible from the paint. Then remove to a piece of glass with a knifeblade and mix the resulting solid pigment with just enough gasoline to make a creamy paste. Use a color which will contrast well with the color of your car. If a gold monogram is desired, use a varnish body for stenciling and paint over it with the gold paint later. With the paint prepared, apply the design to the car

A Flat Brush with Stiff Brisiles

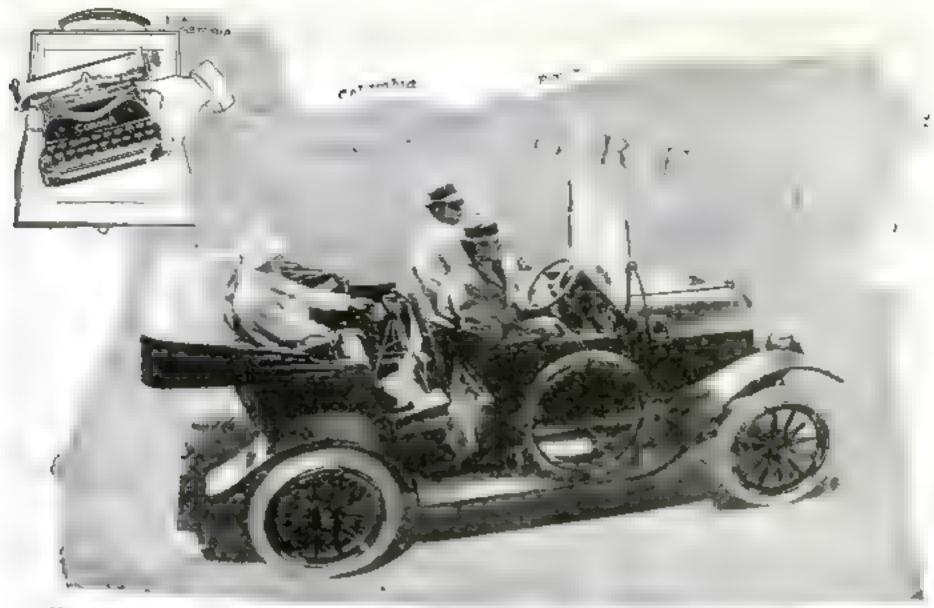
Hold the stencil against the car over the roughened spot with the left hand. Spread the fingers so as to apply as firmly as possible all around the edges of the paper. Then dip the brush in the prepared color and wipe off the surplus on a cloth. Hold it in the right hand well down toward the bristles and rub briskly back and forth across the design until all the spaces are filled. Use a stiff-bristled brush with a flat edge. Be careful not to allow any of the color to creep under the edges of the stencil as that will only have to be wiped away later.

With this done, pull the stencil away from the surface, being careful not to side in a sidewise direction.

The last process is to fill in the spaces left by the binders and go over the whole design a second and perhaps a third time. This is best done with the use of a mahl-stick. One can be made by wrapping one end of a stick with cloth and resting this covered end on the top of the door. Then, by holding the other end in the left hand, the stick can be used as a rest for the right arm or wrist. This stendies the hand filling in the letters. Use an artist's pointed brush for the final filling in and a rather free-flowing paint containing dryer. Do not have it too free, however, so that it will run down over the edges of the letters.



Hold the hand well down near the brush braties and rob briskly back and forth



—and they Coronatyped all over Oregon!"

IN 1917 Corona recorded a 1400 mile motor journey of E. T. Buzzelle, of Salem, Oregon, whose job was to make a property inventory for the Washington-Oregon Telephone Company. The trip was accomplished through all kinds of weather and over all sorts of roads, and Mr. Buzzelle kept on typing, often when the car made 30 miles an hour. Despite a coating of sand and dust, Corona finished in excellent condition.

Your Corona may never be subjected to so severe a test; but it is interesting to know that its lightness and compactness have been achieved while still retaining full measure of staunchness and "write-ability."

Price \$50 with currying case.

Consult your telephone book for name of nonrest Corona dealer.

CORONA TYPEWRITER COMPANY, Inc.
GROTON N. Y

CORONA

The Personal Writing Machine

A Telescoping Triped Stand

Marie of voltages himse taking, fluring nickeled. Provided with copylichter. Adjustable to flure different helpton, 18 is lighten long when folded. Conseniers anywhets, especially when nut-district towallog. Price, 80,00.

:Fold it up — Take it with you — Typewrite anywhere



Home from the summer vacation!

Suit cases and tranks are opened, and out come soiled little compets and amocks, and messed white exists and blonzes. All pred washing I

But the 1900 Cataract Electric Washer stands tendy to receive those clothes and make them spotlers !

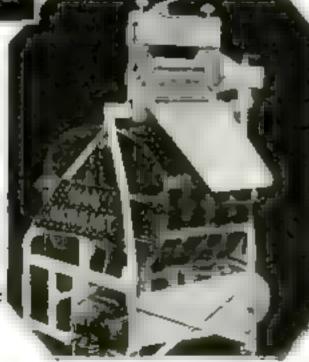
Its gleaming copper tub rocks back and forth, sending the water through the clothes in the magic figure & motion—an exclusive feature of the 1900 Washer which forces the water through the clothes four times as often so in the ordinary washer.

The wringer also works electrically, and can be shifted to any position. No wear and tear on the clothes either, for there are no parts in the tab to eatch the clothes. Nothing to left out and closh after the weak is finished!

The 1900 costs less than 2c an hour to operate and washes the clothes in 5 to 10 m nutra. If you would know more about it, write for "George Brinton's Wife," an interesting story with some suspensing facts.



Fin the popular



1900 CATARACT WASHER

1900 WASHER COMPANY, 206 Clinton St., Binghamton, N. Y. Canadian Factory and Office, Canadian 1900 Washer Company, 357 Young St., Toronto

After the final coat is bone-dry, go over the design with a coat of this automobile varnish as far as the edges of the roughened part. If carefully done, the meeting of the old and new varnish will be hardly perceptible.

In the case of gold paint, use a varnish base. Then when that is dry, apply the gold thinned in lacquer. Then varnish as before.

Of course the design may be embellished with fine bair lines, etc., around the edges of the letters, stripes down the middle of the letters or letters of various colors.

After using the stencil, be sure and wipe all traces of paint from the edges and sides before applying to the other door

With a little practice perhaps you will become expert enough to make monogramming a side line.

How to Remove Obstinate Valve-Stems

DID you ever wrestle with a tire valve-stem that had become stuck below the top of the valve? They are obstinate things, but here is a simple way to remove them:

Take a large cotter-pin that will fit easily inside the valve and file two or

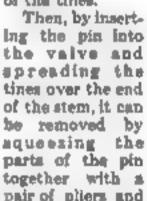
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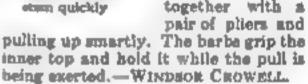
PLICES AND FULL

Showing how to

remove a valve-

three little barbs inside of each end of the tines.







I is foolish to ask if you have ever lost your collar button. You have, of course; every one has. The next time you lose it, make an emergency one from shirt buttons.

Take two shirt buttons, one a little smaller than the other, and sew them



A coller button made from two shirt buttons is an excellent substitute together as shown in the illustration, leaving about 1/2 in. of space between them. Then make a few turns of the formation of

thread strands between the buttom to reinforce them and your emergency button is complete.

This button is worn just as the metal one is worn, and it will be found to take up less space in the collar band of your shirt.—C. D. Zellar.



The Hands of a Nation

OVER half of the working hands of the nation are doing their daily tasks in Boss Work Gloves.

They are a sure protection against dirt, dust, grease, paint and many minor injuries.

They are heavy enough to wear well, yet light and flexible enough to allow you to "feel" your work. They are easy to slip in-to and out-of.

Thousands of painters, ironworkers, gardeners, blacksmiths and farmers awear by Bose Work Gloves.

Workers in hundreds of different lines of trade wear them every day. Women find scores of uses for them about the house.

They are supreme on the hands of the Nation.

Everyone should keep a pair around home, in the automobile, at the office or the shop. Slip them on whenever hand work is to be done. Priced so low that you can afford a new pair every day if necessary.

Ask your dealer for Boss Gloves. Sizes for men and women, boys and girls. Three styles of wrist, band, ribbed, and gaustlet. One of these popular models will be just what you need.

THE BOSS MEEDY—The world's favorism work glove for odd jobs around the house and garden, and all light hand-work. Made of the best quality, medium weight current flannel.

THE BOSS REVY—The best best for all work that requires a strong, wear-recisting glove. Mede of the very best quality, heavy weight canton finned.

THE BOSS XTRA HEVY—

The world's champlon
beavyweight handwear for
rough work. Made of the
finest grade of extra heavy
capton finnes.

THE BOSS WALLOPER—
This is the super work giove. Strong, Sections and built for rugged work. Made of the highest quality, heaviest weight canton fannel.

The Boss Inc Includes highest quality leather-pales, juries, ticking, and contro flanned glasse and militare.

THE BOSS MANUFACTURING CO., Kewamos, III.

This Tridge-mark identifies gengine Bang Work Giovas.





Dayton Bicycles

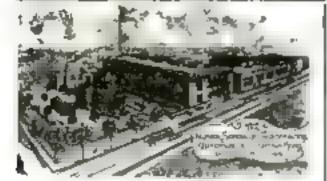
- I Take you to work or school quickly,
- Promote health through mild exercise.
- 3 Bring the fun of swift, ellent flight.
- 4 Savetime for men; earn money for boys.
- What else can you buy for so little that will bring you so much? Think!

Write today for your dealer's name and copy of handsome new 1921 Dayton Catalog No 44 showing 6 models for men, women, boys and girls.

Cycle Dept. THE DAVIS SEWING MACHINE CO., Dayton Ohio



We hard this Prode March



Write for full particulars of our courses.

THE PALMER SCHOOL

(Chiroprocite Fourtisin Head)

13th and Brady Streets, DAYERPORT, leve, U. S. A.



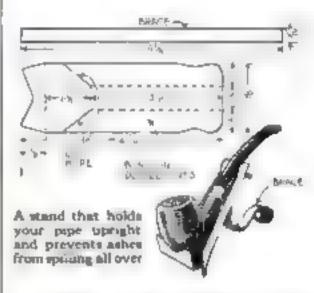
B. GUTTER & SONS, Wholesale Jewslere 177 Hanna St., Division 134, New York, N. Y.



A Stand that Will Hold Pipes Upright

EVERY pipe-smoker knows that the instant he lays down his pipe it tipe over and spills ashes. Naturally it is impossible for friend wife to keep the house clean when this is the case, for the minute she sweeps up the ashes, more are deposited. Then, too, these hot ashes either burn holes in the table-covering or carpet, or cause the varnish to turn black.

To prevent this nulsance, a neat and decorative little pipe-stand may easily



be made from a thin sheet of copper or bram. The pattern is carefully scratched in with a scriber or steel point and then cut with a hacksaw, bent over into shape on the edge of a table, or other hard surface.

All dimensions are given in the illusration, which needs no other description. The back of the stand is soldered to the front after the parts are made.

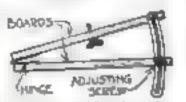
The metal is then cleaned with emery cloth and polished and varnished to prevent it from tarnishing.

When You Take Pictures at an Angle

In order to take pictures at an angle, a convenient tripod arrangement can easily be made. It consists of two thin boards, from 1/2 to 1/4 in. thick, fastened together at one end by a hinge.

The center of each board has a small hole. Into the lower hole a nut is countersunk so that the board can be

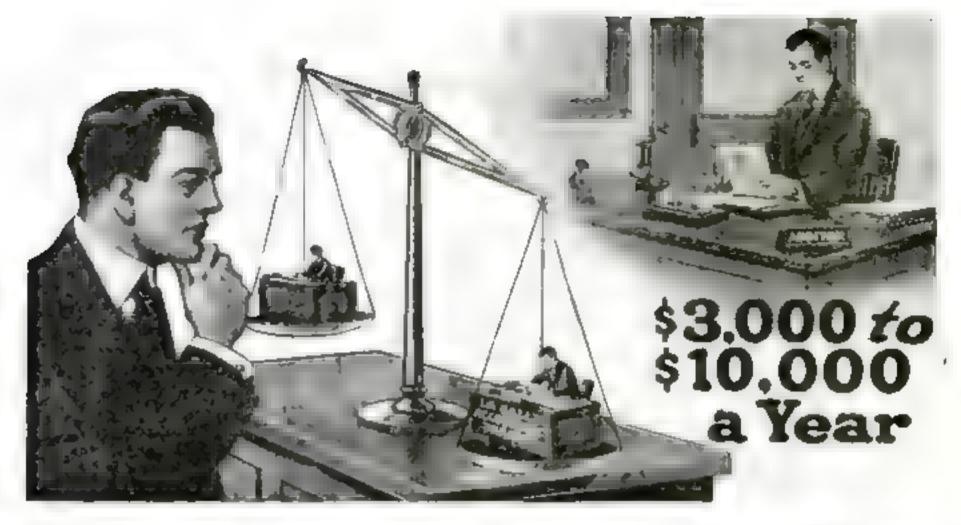
tightly screwed to the tripod plate. The other hole receives a winged box with which the camera is fastened to the support. At the farther end of the upper board a thick staff wire is attached so as to be movable.



Fasten two thin boards together with a hinge and take pictures at any angle

The lower extremity of

the wire ends in a long loop which fits into a nut and bolt arrangement so that the camera can be tilted and locked at any angle.



The Accountancy Trained Man Wins!

EVERY ambitious man strives for three things: First, promotion; second, increased salary; third, larger business success.

In the race for these things the man thoroly trained in Higher Accountancy by the LaSalle Problem Method has a tremendous advantage over the untrained man. It has enabled thousands of ambitious men to step from ordinary jobs into important positions with high salaries.

The Accountancy expert is capable of improving his employer's system of bookkeeping and cost accounting. He is able to warn his firm of approaching dangers from increased costs and decreased profit. He knows every minute just where each department stands in relation to production cost and profit.

Such training in Higher Accountancy as is offered by the LaSalle Problem Method of home-training can easily be completed in your space time without interference with your present position. Why should it not produce the same results for you as it has for the men whose letters appear below?

"As a result of LaSalle's training in Higher Accountance I increased my salary 30s per cent's hist eleven poolsh from date of entorment." We kt

"I am now auditor of this company. While I have not yet fully completed the course my salary has been increased 600 per cent. all as a result of your training."

G. W. A.

"Before I decided to take up this course I was receiving an ordinary bookkeeper's and ary I am how a director and secretary of the company." W. M.

"I am now accertified Public Accountant and have been connected with an Atlanta from of accountants for the past year. Ms earnings have increased over 200 per cent. W.W.D.

Today business does not pick men for advancement for any other reason than that they have acquired specialized knowledge and training which his them for important duties. Specialized accountancy knowledge and training are now available to every ambitious man through the bome-training course of LaSalle Extention University

If you are ambitious—if you want to progress—stop hoping that promotion and increased salary will be thrown your way. Open your ears to the crying need in all lines of business today for highly trained Expert Accountants! It is a fact that such men command salaries of from \$3,000 to \$10,000 a year and more!

If this is the kind of position you hope to fill some day—now is the time for you to begin to train yourself for that job—make yourself the man who can best fill the position of an Expert Accountant—make such a high-salaned executive position sears?

You can train in Higher Accountancy by man under the direct supervision of W. Jiam B. Castenhols, A. M., C. P. A., former Comptroller and Instructor, I inversity of I limits, assisted by a large staff of Certified Public Accountants, including members of the American Institute of Accountants. You will be thought trained in the same methods which these men use in their work.

LaSaile does not train you in Higher Accountancy by requiring you to mean the a multitude of principles and then carting you adrift to apply them as best you can. On the contrary, you are trained by the famous LaSa le Problem Method' by which you actually work out for yourself every kind of problem entering into the duties of an Expert Accountant. In effect, you are taken behind the scenes of big business and into every department, Your training in this connection is under conditions which approach as nearly as possible those which would exist were you actually at the desk and un the high-salaried Expert Accountant a jubyou are training to fail.

LaSatle training will give you a mastery of the underlying principles of Modern Business Analysis, Organization, Accountthe Auditing, Cost Accounting, Commercial Law, Income Tax Work, etc. Laballe accountancy training will enable you to pass C. P. A. examinations, had a ligh-salaned executive position with a business organization, or to enter business for your-self as an Expert Consulting Accountant.

Investigate this attractive and well paid field for specialized ability. Fill in and mail the coupon today. We will send you full particulars explaining the Lahal e ' Problem Method' of home-training in Higher Accountancy. We will also send a copy of the famous book, 'Ten Years' Promotion in One—a book which tells how men with the aid of Lahalle training I are gained in one year promotion which men without this training have not realized in ten.

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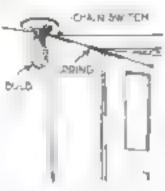


Opening the Door Turns On the Light

THE electric light in a storeroom was made to turn on automatically when the door was opened by simply connecting it as shown in the illustration.

Being of the pull-chain type of light socket, the two movements required to

turn it on and off were alike.



Make the door operate the light switch automatlcally

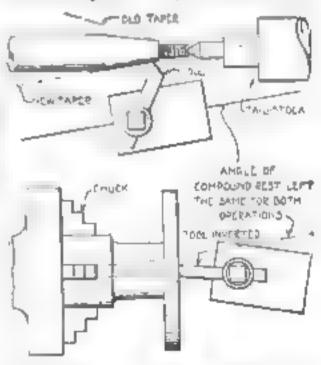
The chain was connected to one end of a screen-door spring by a stout cord. The other end of the spring was then connected to another length of cord, which was fustened

Will

The apring prevented damage to the switch, and when the door was opened the light was automatically turned on. Then, as the door was opened again when the occupant left, it was switched off.

A Way to Replace Your Magneto Couplings

A SIMPLE way of replacing a coupling and magneto when the taper is worn is to true up the taper by using the compound rest on a lathe (not by moving the tailstock). Set the compound rest so that it will turn the new taper as shown in the illustration. After the taper has been turned on the magneto shaft, do not move the



The taper on a magneto compling may be easily trued up by setting it in a lathe

compound rest, but leave it at that setting.

Put on the chuck, and turn up a new flange coupling, finishing it all but the taper. Then turn the boring tool upside down and run the lathe the same way as before, the tool cutting at the back instead of the front. The taper must be the same and the coupling will then fit perfectly.

USE DREDNAUT

DETROIT

The Simplest Drill-Press that Can Be Made

HERE is the simplest thing there is in the way of a drill-press. Use the ordinary hand-drill for the "business" part of the apparatus, and secure it to a board. The exact method of securing it will depend largely upon the construction of the drill, but for one which has a handle in the frame, this can be unscrewed and a machinescrew of the right size and thread put



An ordinary hand-drill and a wooden frame will make the simplest possible drill-press that does excellent work

through the board and into the frame of the drill, in addition to which there must be another fastening to keep the tool in line.

For the feeding mechanism, use a steel rod or a piece of tubing-substantial brass tubing will answer—and arrange it to slide up and down in brackets under the drill-press, taking care that the rod is in line with the shaft of the dril. A little table on the top of the rod hads the work, which may be secured by means of an ordinary clamp. A lever acting on the lower end of the sliding rod serves as a feed, and is hung on a leather strip. As the holes drilled are rarely of any great depth, the tool can be arranged so that the operator sits in front of it and operates the feed lever with his knee, leaving both hands free.

Another way in which the same principle can be applied in to rig a similar apparatus, but on a somewhat larger scale, using an ordinary brace and bit instead of the hand-drill. Some braces cannot be used in this way. The best for the purpose is the cheap kind without ratchet. This is surprisingly convenient in many cases, and it has the advantage that it will bore long, straight holes with very little trouble and, by using a fairly long lever, as much pressure may be applied as is necessary for large bits.



Why Teeth Stain

You leave a film-coat on them

All statements approved by high dental authorities

Most teeth are dimmed more or less by a film. Smokers' teeth often become darkly coated.

That film makes teeth look dingy, and most tooth troubles are now traced to it

Millions now combat that film in a new, eccentific way. This is to offer a test to you, to show the unique results.

You must end film

The film is viscous—you can feel it with your tongue. It clings to teeth, enters crevices and stays.

Ordinary brushing methods leave much of this film intact. So milbons find that well-brushed teeth discolor and decay. You must attack film in a better way, else you will suffer from it They, with terter, are the chief cause of pyorrhea.

the teeth to cause decay.

Efficient ways

It is the film-coat that discolors.

not the teeth. Film is the basis

of tarter. It holds food substance which ferments and forms and.

It holds the acid in contact with

Millions of germs breed in it.

Dental science, after painstaking research, has developed effective ways to fight film. The world's highest authorities now approve them, after careful tests.

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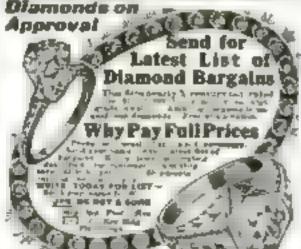


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Making a Useful Bathtub Drain-Cleaner

BATHTUB drain-pipes will get clogged up at times and prove very difficult to clear on account of the small diameter of the discharge pipe. After working over three hours with a plumber's rubber suction pump. that failed to remove the deposit, the writer made the device shown in the illustration that did the work in less than two minutes.

Obtain from a hardware store a tapered rubber plug measuring 1 1/2 in. wide screen the top and 11/4 in. wide at the bottom. The plug as bought will be found to have a rubber ridge on top, to which is fastened a nickelplated lifting-ring. Cut the ridge off level with top and hore a hole in the center a trific amaller than the outside



Don't call the plumber when the drainpipe clogs, for you can make a device which will free it of any deposit

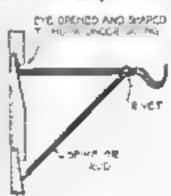
diameter of a short section of be-in. iron pipe, the latter to have a length of 3 in, and be threaded for all its length, or partly so, as preferred. Run a coupling on threads of pipe, then acrew the latter through the rubber plug, after which place a locknut on the end of pipe to hold plug in place. Put the coupling close to the plug so as to grip it tightly. Place plug in place in tub and measure the distance from coupling pipe and to the shoulder on the double faucets, allowing it to be a little longer than is necessary. Then buy the required length of red rubber tubing of be in, inside diameter to fit the pipe near coupling, fastening the tubing tightly with wire, and the job

To use, put the tube end on faucets first, as far as it will go, then put the plug in place. If the tubing has the right length, it will be straight, and owing to its slight extra length, from the measured dimensions, it will exert a thrust against the bottom of tub and stay in position against a water pressure of 90 lbs. or less; thus obviating the necessity of holding it in position while in use. When bought, the tubing will be found to be curved -and it will remain so—but this is an advantage, as it helps the cleaner to stay in place while in action.

HERE is how a paint-pail bracket hook. This painter was a crank on books and declared that he would quit the job unless he was provided

with a paint-pail hook of some port. When it looked as though the wielder of the brush would pull his stakes and depart, the handy man of the place hove Into view with a hook made trom an old 6-in. door-book. The

eye which origi-



Why reach down for the paint pail when you can make this

nally accommodated the staple was straightened out and flattened in the manner shown above. Lakewise a 20-penny spike was flattened at one and after the head had been removed, and a hole was drilled through it. A similar hole was drilled through the square door-hook about I in. from the end, as shown, and the two held together with a rivet. All that was necessary then was to bend up 34 in. of the flattened end, which, when in use, slips under the edge of one of the clapboards or sheets of siding. The point of the spike is set to bear against the side of the building lower down, to bring the book out at right angles to the building, and the paintpail is hung on the outer end as shown. - DALE VAN HORN.

To Repair a Curtain-Roller that Has Split

WHEN cutting a wooden curtain-roller to an undermsed window, it sometimes happens that the grain of the wood runs very much on the blas. Driving a stout pin into it may

FIG. t ea ce BOLT OIL SCREW-FIGZ BEASS CAP BRADS : FIG.3

An improvised roller cap can be made from an old bettery terminal end

cause a portion of the roller to aplit off, as in Fig. 1.

A good preventive for this fault is to use the bram cap from an oid dry-battery The carbon. cap is provided with a screw which answers the purpose of the pin (Fig. 2), Break the

battery carbon off level with the rim of the cap and crack it in pieces, then remove the pieces, Set the eap on the end of the roller and secure it with brads as shown in Fig. 3. Should the split occur despits your care in cutting it down, the wooden parts may be gived and then secured as described.

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PERHAPS you think you might get the training you need in a factory or a general. I may no to that. During the war a factory man was being examined after his enlarment to had out what he could do best

""What as your vocation?" the exaraner naked

"Automobile man," the soldier mid-"'Where did you work?'

""In a factory in Detroit." ""What did you do there?" ""I tightened boft 14.

"The Pick (1966) than in factors shop or garage hids that notods is anterested in making him an all area of man.

"THERE'S only one way to get thorough information about motor machinery. You have to get your bands on it and into it while somebody who knows all about it explains the workings and the whys.

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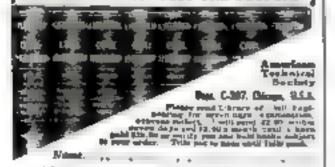
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Making an Air-Compressor of an Old Boiler

HERE a steady supply of air at pressure is required, it can be obtained by using an old water-tank, such as is used for hot water, and connecting the tank with the water supply in any convenient way. The idea is to allow water to run into the tank, thereby compressing the air in it, and

piping the air to the blowpipe or other work from the top-

When the tank becomes full, the water is drained off; but where the volume of air required in not great, a very conriderable amount of work can be done on one filting of water.

HOT WATER TAhK HOSE TO PACCIT DBARH-COOK Compressed-air plant

tande from an old kitchen boller

It will facilitate matters and economize water and time if the tank is first pumped up to working pressure with an ordinary foot-pump connected to the air outlet. After that, any desired pressure can be obtained by regulating the flow of water. If the tank is old and leaky, it can be made serviceable by coating the inside with tar, heating the tank in order to keep the tar liquid long enough so the tank can be rolled around to carry the tar to all parts. Drain out the surplus through the openings. Needless to say, all valves must be removed while this is being done.

A Spark-Plug Tester for the Use of Garagemen

T is difficult to determine the condition of a spark-plug, unless the plug can be subjected to pressure, for under atmospheric pressure a spark will leap across the electrode gap. even if the porcelain or mica is broken down. For this reason, every garage or repair-shop should have a compres-

SPAZIMPLUG BERNG 165169 LANGE PIPE MIPPLE NR-Tank COMMECTION SPARE PLUG GASKET THEF OU PLA I G.ASS

This spark-plug tester will detect defects immediately

sion tester, a device in which the plug may be placed and aubjected to a pressure of from 60 to 75 lbs. a sq in, then connected with a coil and the action of the apark noted.

To make such a testing - box. obtain a 4-in. tron pipe nipple, about 6 in. in length, and

fit it with two pipe caps. In one of the pipe cape drill and tap a hole large enough to receive the spark-plug. Usually two testers will be necessary. one for 14-in. plugs, the other for 34-in. plugs, since these two sizes are most common.

In the other end drill two holes; a small one, about 1/5-in. pipe-thread size, the other for a 🥞 in. spark-plug. The smaller hole is for connection with the compressed-air tank, or a tire pump, while the larger, which should be in the center, is to be fitted with a second spark-plug, especially prepared.

This latter spark-plug is to be used as a window, so the porcelain must be removed and a round piece of plateglass substituted.

A Simple Tire-Remover for Split Rims

NY ONE who pulls and tugs on a aplit rim in an endeavor to remove the tire is as foolish as the fellow who tries to blow up a tire with his mouth and lungs. It is an easy matter for any one to make a split-rim contracting-tool that will do the work without wasting one's strength.

The easential parts are three chains, three hooks, and a twisting-post. The latter may be made from a piece of 2-in. from pipe, about 6 in. in length. Each of the three chains is fitted with a hook which is bent to fit over



The pipe revolving upon the chains and claimpe easily pulls out the split this far enough for it to be removed

the edge of the rim. The other ends of the chains are fastened to the pipe and spaced 120° apart, as shown in the sketch.

Two holes are drilled in the 2-m, pipe at opposite sides to admit a 54-in. bar for twisting. To use the device the chain hooks are put into place on the rim and the pipe given a twist. This action winds the chains around the pipe, yet so great is the laverage obtainable that little actual strength is required to contract the rim. The illustration clearly shows the device and its attachment to the rim.

Try out this idea, and removing and replacing tires will be an easy job. If a little graphite is applied to the rim at the time of removal, tire-removing will be made even more easy.

For those who have bruised their fingers in removing split rims, this tireremover will prove invaluable, for it eliminates all chance of injury to the person operating it.







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A Tube-Pulling Wrench that Is Easy to Make

NUMBER of short tubes or A bushings which were a snug fit in larger and longer ones were to be removed, and after machine work was performed on them they were replaced.

A wrench to grip them on the inside was needed, since that was the only place to get a grip to remove them.



An entirely efficient tube-pulling wrench can be made as described in this article

The illustration shows the tool made for the work.

A piece of tool steel A was turned in the lathe to the shape shown, the size G was muchined for the length of the dimension E to a sliding fit on the inude of the short tubes.

A small hole was drilled through the center of A nearly a third of its length, and a larger one two thirds of the way from the larger end.

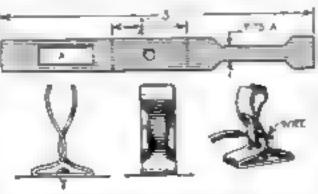
A cone was formed at C and threads tapped for a short distance in the larger hole at H. Narrow slots D were cut in the milling machine and a pin B with a cone point the came angle as the one at C, which, when made to fit was trued up and a hole bored at the outer end for a short pin to serve as a handle. The pin was threaded to match those at H. By turning this pin against the cone C the sides of the slotted portion of A expanded and had a tight hold on the inside of the small tubes.

The shoulder P gaged the tool to a certain depth.—E. S. Goodell.

A Spring Binding-Post Made of One Piece of Metal

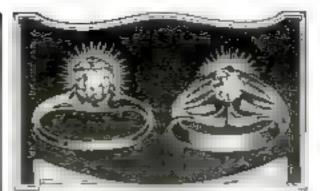
BINDING-POST made of one piece of metal makes a handy accessory for the amateur electrical It is instantly adexperimenter. justed, simple to make, and costs little.

Cut a piece of heavy spring brass the shape and dimensions shown in



A spring binding-post made in the manper illustrated insures a tight connection for electrical current passing through

the detail sketch. A No. 16 or No. 18 gage will do. The hole in the center



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in to fasten the post to a suitable base. The narrow section is bent so that when it passes through the oblong opening in the opposite side, sufficient space will be provided between the two pieces before the ends of the opening interfere.

Also see that the tops of such side of the post do not touch before this same space is evident. Otherwise, the wire cannot be placed in the opening without some difficulty.

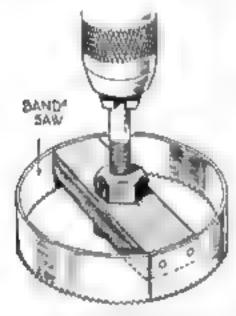
The metal should have sufficient apringiness so that when the ends are released, the wire will be held securely between the sides of the post.

These can be used to connect the ends of two stray wires or to fasten to apparatus as permanent posts.

The Way to Cut Large Holes in Wood

A LTHOUGH this method of cutting large holes may be used for cutting thin metal, and even glass, it is more practical for use on wood, especially where such devices as clocks, ammeters, etc., are to be installed on the dashboard or instrument board of an automobile.

Obtain an old strip of band-eaw and draw the temper by heating it to a



A strip of band-saw bent lutu a circle and riveted will cut may nice bole

red heat in the fire, then letting it cool. The saw may then be bent into the circle desired and the ends cut and riveted to make a complete circle. After this is done, round off both ends of a flat piece of oak board to fit the inside of the circle and with four brade, fasten the circle to the board. Find the center of the device and pass a bolt through the board, thread on a hut, and it is done. It may be used in a bit-brace and will cut a perfectly round hole.

If more than one hole is to be cut, or if the device is made for use in the garage, the saw should be tempered again after it has been bent and riveted. To do this, heat to a bright cherry red, quench in water and draw the temper by holding for a short time in the heat, until the metal turns to a dark blue.

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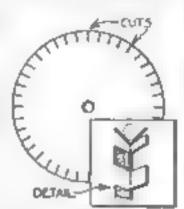
Making Grooved Pulleys from Tin

WHEN you wish a grooved pulley for a toy machine, model, or other light use, you can make one out of sheet tip as described and save the expense of buying one.

Cut out a disk of sheet tin about 14 in. larger in diameter than the pulley. Punch a hole in the center for

the axle. Then from that point, acribe a circle on the tin with a sharp point. This should be 12 in, less in diameter than the tin itself.

Then cut at right angles to the draumierence with tin- shown ner's shears as



Cut the edge of the disk, and bend to make logs m

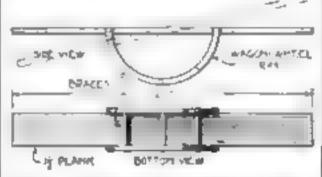
far as the scribed circle and about 35 in, apart, completely around the tin. This will leave lugs 14 in, high and 12 in, wide which, when bent outward alternately, will form staggered sides of a groove and form a sort of grooved pulley which will serve all practical purposes.

These dimensions for the lugs will do for all ordinary parrow belts, but can be varied to sult any conditions.

Seesaw Made of Plank and Wheel Felloes

HANDY form of seesaw for the A children is shown in the accompanying illustration. It is portable, and thus makes itself useful in any location without having to hunt for a raised position on which to rock it.

The plank is of oak or hard pine 12 ft. long by 12 in, wide by 139 in, thick, To each side, in the center and in exact line with each other, holt two sections of a large wagon-wheel rim or felloe. These usually come in half

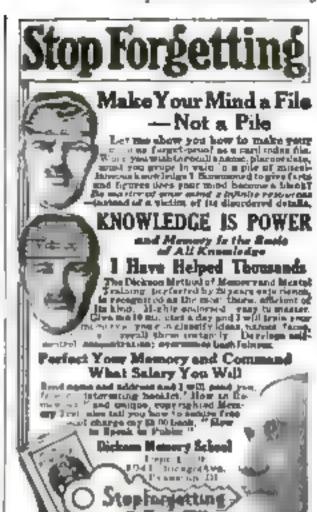


The half wagon-wheels combining with the plank to make a safe secare for the children.

sections, but should be cut a trifle so that they do not make complete nemucircies.

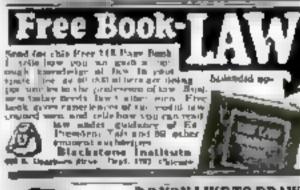
Then insert several braces between sections as shown so they will keep a uniform distance apart.

This is a good idea for the children, because there is less danger of whirling and the possibility of the plank throwing itself off its fulerum and giving the riders a bad fall.





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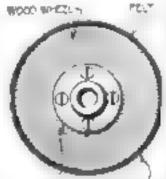
Emery-Wheels Are Easily Made at Home

T is not hard to make an emery-wheel that is very serviceable. In fact, it is so easy that no amateur mechanic need be without wheels of almost any

desired size and any grade.

The first thing to do in to make a wood wheel of the right size, have it perfectly true and, preferably, run it on some sort of a metal hub. Around the rim glue securely a layer of felt, binding the fabric tightly while the glue is drying and using a broad binding so that the felt will not be uneven. Then coat the feit surface with hot glue and roll it in emery or earborundum or whatever abranive is to be used. Have the abrasive hot-a good deal too hot to touch. It is important to have both glue and emery very hot. Put on

three, or even four, conts of abrasive, waiting till one is thoroughly dry and hard before putting on the next. Wait a good long time to be quite aure of the hardness and dryness. This method is much more satisfactory than the common one of trying to make the abra-



AND GLUC PHO-

A layer of felt is glued to the wheel. Upon this are several laypre of abrasive

sive stick to a plain wood surface, and is also an improvement over the use of a leather band as a base for the

abrasive.

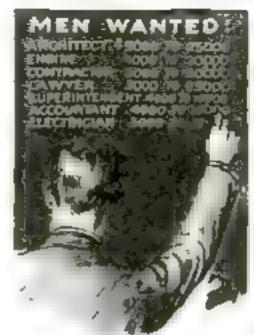
Guarding Automobile Springs from Dirt

THE leaves of an automobile spring are intended to slide upon one another when the car is in motion. Many drivers allow their springs to get dirty, to go without lubrication, and to become very rusty. The leaves become so dirty that instead of shding on each other, they work almost as if they were one solid piece of steel. Then, when the car strikes a hole or a bump in the road, the springs are compressed, and instead of each leaf working as a separate unit, the lower leaves of a rusty spring are held fast to the upper leaves and the reaction from the compression of such a spring is many times greater than the reaction of a clean, welllubricated spring where the leaves are , allowed to slip one on another.

The first step toward a remedy is to keep mud and dirt and all foreign matter away from the springs. This can be done by covering the springs with boots, sewed together, made of a good grade of leather substitute. This material is thoroughly waterproof and will keep dirt and moisture away from the spring. The lubrication on springs protected in this way will remain in

place a very long time.

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respondence schools that I know of, and am glad to recommend it to my one to need of a course, as I less that it beloed me greatly in my work.

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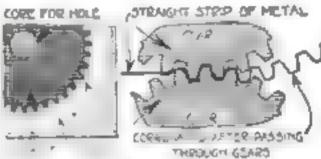
POPULAR SCIENCE MONTHLY 225 West 39th Street, New York

Making Gear Patterns in Sheet Metal

By Thorton Hallett

CI EARS for temporary use, as in model-making, experimental purposes, etc., can be made in the following manner by casting in soft metal and will be the means of saving much time, effort, and expense.

First, it will be assumed that the gears are to run in conjunction with some already in use, so they will have the same tooth dimensions and general characteristics. Make a note of the thickness, diameter, number of teeth,



The pattern and eand box are shown at the left. At the right in the strip of tin being perforated through the gears

etc., that the gear you desire to make shall have, and then proceed to duplicate the teeth of the once you will copy as follows:

If possible, adjust the gears in mesh so there will be some play between the top and bottom of the meshing teeth.

Then procure a strip of light, soft sheet instal as wide as the thickness of the gear desired and three and a half times longer than the distance around the circumference. Start the gears on the machine and very carefully feed the metal between them, just as washing is fed to a clotheswringer. Be sure and hold it steadily at right angles to the face of the gears and do not force it through. The result will be that the strip will be pressed into corrugations exactly duplicating the teeth of the gears and can then be used for the pattern of a similar one.

When sufficient teeth impressions have been run into the metal strip, remove it and hend it into a circle and rivet one end to the opposite end so that the required number of teeth are included. Then anip away the surplus metal.

Make a shallow wooden box somewhat larger than the desired gear and mark a point in the exact center. Then with a compass, scribe a circle the outside dimension of the gear on the bottom of the box. This is used as a guide when laying the metal pattern out. Then affix a metal or clay spindle to the center of the box, which will act as a core for the shaft opening of gear.

When this is done, set the pattern over the core and arrange in as good a circle as possible about the core. Then pour in wet sand between the pattern and the sides of the box, and pat down, gently forcing it against all portions of the pattern until it essumes a perfectly circular shape, as indicated by the mark of the compans.

Then, without disturbing the arrangement, pour in the casting metal. This can be lead, pewter, or habbitt metal for such temporary gears. The result, when cold, will be a very fair gear of soft metal which will mesh with its mates as well as a cut one.

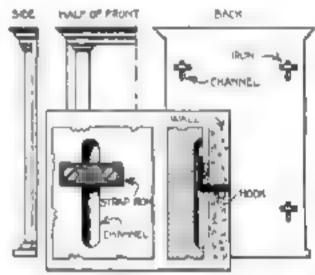
The keyway can be cut with a chisel, If the circumference is at all out of true, there will be sufficient metal in the casting so that it can be trued up in a lathe without sacrificing anything necessary. A shaft hole can also be quickly reamed out if necessary.

This mold can be used over and over again if a sand bottom is used and the pattern is kept trued up to a true circular form.

An Easy Way of Fastening a Wall Tablet

To attach a "Roll of Honor" tablet to the wall of a lodge room, and also to arrange it so as to be readily removed if necessary, I fitted it as shown in the illustration.

Securing two small angle-irons I cut them so as to get four straight pieces. The reason I used angle-irons



Showing the side, front, and back of the tablet and how it is attached to the wall

was that they were already bored and countersunk for screws. Four channels were then gouged out immediately back of the pillars, and the angle-irons acrewed across them. Four right-angled screw-hooks held the tablet against the wall. Lafting up and out would permit the tablet to be removed.

To allow for inequalities in the wall surface. I fitted the tablet so as to allow 15-in. space between it and the wall, but I could have made it fit snugly by setting the angle-irons in depressions cut in the board so that they would have been flush with the surface of the back.

When finished, the tablet will be flush with the wall and give the effect of being permanently fastened there. It can be removed for cleaning when

The Two-Unit Electric System

lenition is supplied by the wartested Aero high tension magnetowhich speries at a very low speed, thus randering the Powerplus remarkably sany to start.

The Lighting Unit is composed of a Splitdorf DU direct current generator, and a 6 volt Wice battery. The headlight has a 21 candlepower main bu'b and a 1 candlepower pilot. The san light and born are energised by the same system. A figitidori sero-centro ammeter le mounted on the top of the tank. Single wire system is used through-

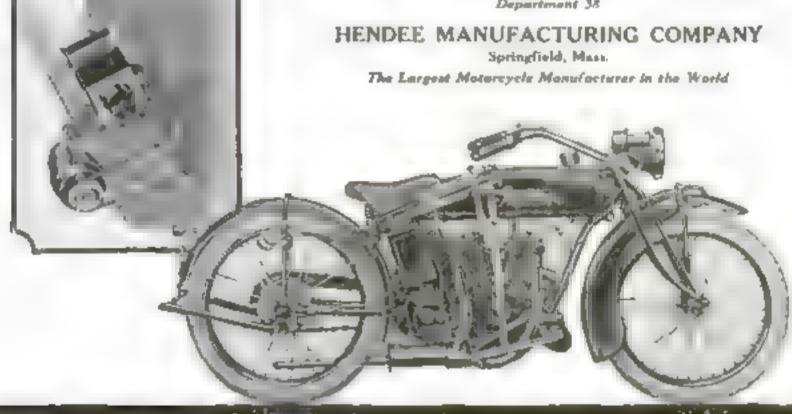
Two-unit electric system sets motorcycle standard

The appearance of the Two-Unit electric system in the 1920 Powerplus justified the dependence the Motorcycle World places upon the manufacturers of the Indian to originate and develop new ideas in motorcycle construction.

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Department 38



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A Compact Typewriter Table and Stool

By Mortimer V. Tessier

ONE of the problems to solve in having your typewriter at home is to provide a proper table and seat which will have all the conveniences of an office without taking up much room and at the same time will make a presentable appearance in the home.

Here is a novel and compact outfit which requires but 31 in. by 1514 in.



A homemode typewriter table that taken but little space and gives one all the conveniences of an office desk

top measure, and is only 27 in, in height. The stool has a hand hole in the center of the seat for handling and fits enugly under the table when not in use

Besides giving plenty of room, as the lligatration shows, for the typewriter,

there is room on each side of the machine for a full-size sheet of business-letter paper, and an upright drawer is provided at each end of the table large enough to secommodate your typewriter paper, envelopes, etc. These drawers swing outward to open on two hinges placed at the bottom of the drawer, and are provided with a knob on the putside and a map catch (such as is used on the doors of your china-closet or sideboard) which locks them when the drawer is brought to a vertical position. The drawer is kept from swinging too far out by means of a short length of small chain, which fastens at one end to a screw-eye in the back of the drawer and at

the other and to another acrew-eye in the lower edge of the upper crosspices underpeath the table-top.

The table shown in the illustration was constructed of cypress wood and afterward given an early-English water stain, and rubbed to a dull polish.

This outfit can be easily constructed at home by the man who enjoys making his own things rather than buying them.

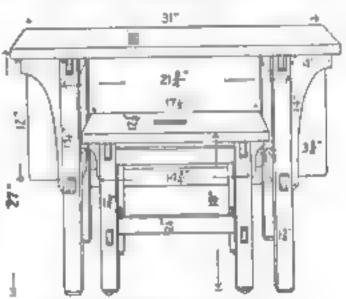
The requirements for lumber, hardware, etc., are rather simple. First, you will need four small brass hinges, two small knobs, two small snap catches, such as are inserted in the edge of the drawer, about one foot of small chain, four screw-eyes, and four 2-in. strap-iron, right-angle corner

braces. These corner braces are applied to the top of the table legs and the under side of the table top to give added rigidity to the table.

Your requirements for lumber are as follows: For the table legs, four pieces 1% in. square and 27 in. long. For the stool legs, four pieces 1% in square and 17 in. long. For the table-top, one piece 15% in. by 31 in. by 1% in. thick. For the stool-top, one piece 12% in. by 17% in. hy 1% in. In thickness. All the crosspieces are of 1 in. by 2% in. stock and the brackets are of 1-in stock, sizes as shown. The drawers are made of 3%-in. stock for front and back, and 3%-in. for the sides and bottom.

General construction: The table-top is secured to the legs in addition to the brackets described above by a large countersunk screw in each leg. The head of the screw is let down into the top of the table about half its thickness and a cypress glue plug is then inserted to fill the hole, and afterward ampothed off

The mortises and tenons in the table shown are worked clear through the legs, for armament as much as for atrength, but if desired these mortises can be made blind. All mortises and tenons are 1 in. by 2 in. The four brackets on the ends of the table are



The table requires only 31 by 15½ inches of space in which to be stored. The stool slides beneath the table

placed flush with the Inside edges of the table legs and the drawers slide back and forth between them and rest against the upper and lower crosspieces when they are closed. There is a crosspiece between the back legs of the table, just below the lower-end crosspieces.

The stool-top is secured to the legs in the same manner as the table and is provided with an "I" cross-brace between the legs. The ends of the stool legs are provided with rubber halfcircular knobs, with a small screw in the center for attaching to the leg.

The top ends of the drawers are stanted slightly inward so that they will clear when brought to an upright position



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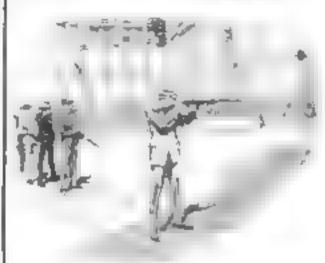
Bept. K a

How to Become a Second Buffalo Bill

Promoting rifle practice for those who like to shoot

By Fred Gilman Jopp

HOW you envy the man who is an expert shot, and how you wish that you could shoot as well. Of course you realize that it takes lots of practice, but that you would gladly do

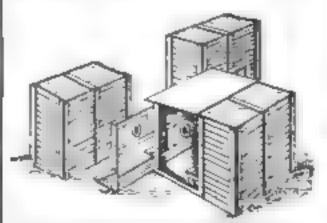


If possible, the range should be located near the town, so that members can reach it for shooting practice after business hours

provided you had a place in which you could learn. Why not construct your own rifle range? It doesn't cost much provided you have a place in which the range can be installed.

Herewith are plans for inexpensive rifle-ranges for the small-bore 22-caliber rifle, such as several men forming a club can erect on any suitable piece of ground in two afternoons' work. Only inexpensive material is required. In many cases old packing - boxes, railroad - ties, and gunnysacks filled with dirt can be used. Often the ground itself will lead to modifications which will decrease labor and expense.

A suitable piece of ground is the first regulate. Any piece of land at least 100 yd. long by 50 yd. wide can be used. If you find difficulty in obtaining the ground, you should apply to your city council, board of trade, chamber of commerce, or to public-spirited citizens. In a number of cases cities and towns are providing places in parks for these ranges. In other cases public-spirited corporations are permitting the use of vacant land. It is important that the land selected is readily accessible. Be sure

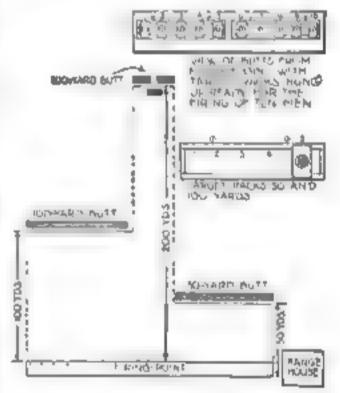


With a roofed-over firing-point in winter, the sides can be bourded in, with loopholes to fire through, and a stove for comfort inside

that the range is safe, and not liable to be closed by injunction. Make positive that bullets will not go astray. Remember that the extreme range of the 22-caliber long rifle cartridge is just about one mile, and that at 600 yd. it will penetrate a 1-in. elm plank.

Relative to the construction of the 200-yd. butts, it is recommended that the target curriers be made large enough to take paper targets about 4 ft. square. In some cases the amateur will find it difficult to keep all his hits on the target, and also to find the target, when he first starts to shoot.

There should be some means of finding and accurately marking the misses. This is easily accomplished by placing a piece of paper about 4 ft. square on the carrier, and then placing or pasting the target in the center of this piece of paper. This sheet of paper should always be painted dark green before pasting the target upon



Here is the 200 yard small-bore butt comprising target-bouse, marker's shelter, target-carriers, and back stop. The construction is simple and inexpensive

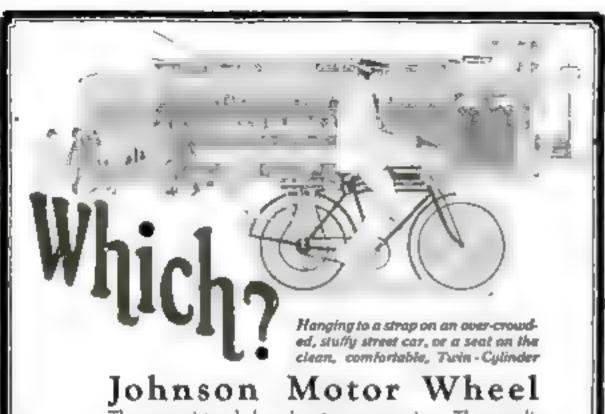
it, giving the target the same appearance from the firing-point as does the large 1000-yd, target on the big-bore ranges, and more closely simulating long-range shooting.

Each member of the team should shoot scores as follows: 50 yards, 10 shots, slow fire, time limit five minutes for 10 shots.

100 yards, 10 shots, slow fire, time limit five minutes for 10 shots; any position without artificial rest. Rifle: any 22-caliber rim-fire rifle; any night not containing glass.

Mr. F. H. Phillips, Jr., Secretary N. R. A., 1108 Woodward Building, Washington, D. C., will furnish any further information and plans. Write to hun.





The scene pictured above is not an exaggeration. These condifrom exist in every community during the righ hours of morning and evening. This picture means much more than is seen at first glance, for a rider on the Johnson Motor Wheel can live far away In the more desirable residence section and go to and from his work in less time; at less expense and in a much pleasanter way than by street car

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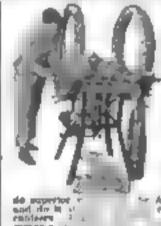
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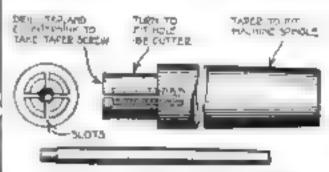
Federal School of Applied Carteoning 5028 Warner Building Minneapolis, Minn.

MrCutchese Carteral from Chicago Fribana

13 Williams Bidg. Indianaralle, Ind., U.S. A. Prest year depth is made distribute.

A Specially Made Arbor for Face-Milling

DECENTLY I was called upon to A do a piece of work on a millingmachine which was beyond the range of any tools I had. The job was one for a face-cutter, but not having any that would reach the work I made a



The arbor may be used for spot-facing and other work done with end-mills

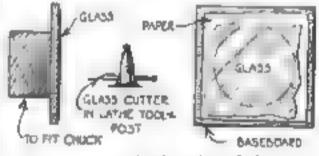
special arbor to carry the cutter as shown in the illustration.

The arbor was tapered to fit the apindle of the miller and turned down as shown to fit the bole of the cutter A hole was drilled and tapered in the end and countersunk to take a taper The ocrew was tightened sufficiently to prevent the cutter from turning on the arbor. - HARVEY MEAD.

Cutting Circular Glass Plates on a Lathe

"UTTING out glasses for headights, etc., is not always easy for the man not blessed with a multitude of tools for glass-cutting, but if he has a lathe, here is the way it can be done.

First build a wooden hase after the pattern shown in the drawing. This can be made as large as convenient,



How to cut a circular piece of glass on a lathe without fear of its breaking

but of course the tool-holder of the lathe can be moved only a certain distance from the center of the chuck, so allowance must be made for that. The block under the baseboard is to attach to the chuck, so make this of a size to suit your own particular lathe.

Since glass cannot be clamped to the base without the danger of a break, owing to the uneven strain of the clamps, a novel way is herein described. First, see that the base is perfectly straight, both across and with the grain. Any excessive warping will cause such curving of the wood as to make it dangerous to attach a sheet of valuable glam.

Next, spread glus to the baseboard and lay on a sheet of heavy manile

paper, spreading evenly to remove all wrinkles. When this is thoroughly dry, give the paper a coating of glue in the same manner and lay on the glass, centering it as evenly as possible. When this second application of glue is dry, the glass is ready for cutting.

Mount the baseboard in the chuck and bring the tail-stock up to the gass to determine the center point. Measuring out from this point will determine the radius at which you will cut

The glass-cutter should be set in the tool-holder so the wheel will bear against the glass at an angle best adapted for cutting. This can be determined by experiment.

Gear the chuck down to a very low apped and bring the cutter against the

glass at the proper point.

When the cut is made, remove the base from the chuck and dampen the paper with water. This will allow the glass to be slipped off and the excess glass broken away.

To Make a Universal Joint | for Temporary Use

A SIMPLE universal joint that may be used in light drilling, valve-grinding, machine-driving, etc., is illustrated which can be quickly made by any amateur mechanic from old pieces picked up around the shop.

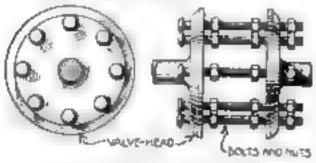
Take two old gas-engine valvestems and drill eight 3 16-in, holes concentric with the circumference and about 3k in, from the edge in each one.

Then take the firing-points from eight old spark-plugs (the threaded style of point) or make up eight sections of bicycle-spoke stock about 1½ in. long. Thread these for nearly their entire length. Head over each piece at one end and provide three nuts for each, making 24 nuts in ail.

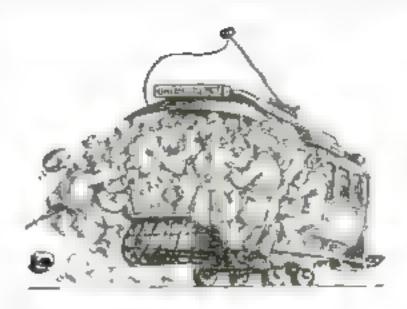
Connect the two valve-heads as shown, allowing some play between the valve-heads and the nuts on the outside. Also allow some room between the nuts at the end of the rods and the valve-head.

This arrangement will allow the valve-stems to be rotated at an angle sufficient to overcome many difficulties in mechanical work.

Practical use can be made of this joint by connecting the valve-stema to shafting as necessary. After the universal joint is constructed and tried out, the machinery about the shop will, no doubt, suggest other ways in which this very necessary piece of apparatus can be used.



This temporary universal joint was made from old gas-engine valve stems and spark plugs



The Public Be Jammed!

Nothing like a ride in the street car at rush boar, if you're feeling lonely. There you will find companiouship a-plenty.

Friendly elbows digging into your ribs, a foot or two placed affectionately upon your own, an umberlie handle carcesing the small of your back.

This is the mode of travel we Americans apparently prefer. At any rate it is all that we pay for.

Yet, though the brave effort of two or more bodies to occupy the same space at the same time may be interesting as a scientific experiment, to the health of the contestants struggling in the foul and germ-laden air, it holds a memore.

But after all, the street railway can't give meany better service than we pay for. Whatever extra cars, extra scats, extra speed we desire can come only from the money we furnish.

The service of street railways, whether sweed by the public or by private interests, must be paid for by the people who ride.

So, how much we pay and what we consider worth paying for, are questions purely up to us.

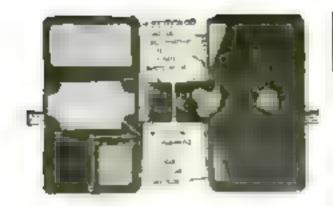
In the face of rising posts for material and labor, shall we hold our railways down to the old fare—and watch the service become less and less adequate as their resources shrink?

Or rather, shall we spend a few cents more each day to keep the street railway equipment in good order, to build up a better service for our own comfort and convenience, and even for our health?

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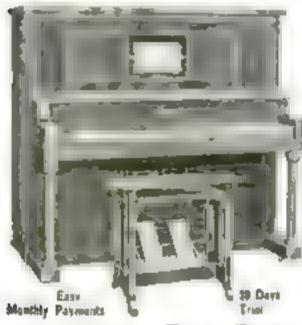
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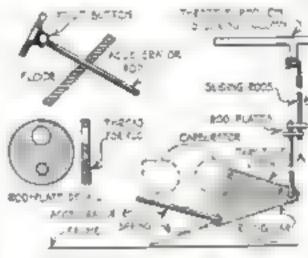
Agents watered for our reedy built phonographs Charless Promptish Co. 1908 Mango Deig, Shhari, Ind.



A Homemade Accelerator for the Ford Car

AN accelerator for your Ford, by which the speed of the car can be controlled by the foot, can be made at home of odds and ends about the workbench at practically no cost. The general layout showing the operation of this idea is shown in the illustration, with all details of individual parts.

First, the rod connecting the rod from the steering-wheel to the throttlelever on the carburetor is removed.



Here are the various parts needed for your homeroade Ford foot accelerator

This is sawed in half. One half is threaded at the cut end and a second piece of similar rod, about 1 in, longer than the remaining half, is threaded at one end and bent and drilled to fit the rod from the steering-wheel. The combined length of these rods should be an inch or so more than the distance from the carburetor throttle-lever to the control-rod from steering-wheel, when carburetor is nearly closed.

Next, cut out two egg-shaped metal plates for slides. These are shown in detail

At the narrow ends drill a hole and tap it to thread on to the threaded ends of throttle-rods. Just above this hole, drill a larger one to slide over the rods easily. Then assemble them as shown in the layout, so each plate slides over the other rod. When they bring up against each other, their combined length will be just equal to the length of the old throttle-rod.

The triangular plate is composed of heavy sheet metal about the shape shown. Drill three screw-holes at the points indicated, also two larger holes for the control-rods.

Then drill and tap three machinescrew-holes in the carburetor lever and attach the plate to it in the position shown.

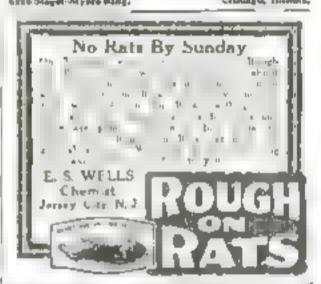
The throttle-lever hole in the plate should coincide with that in the lever

A spiral spring is then attached from the other control-rod hole to the frame, always tending to keep the lever in closed position.

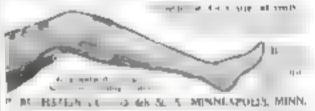
Connect the sliding rods in position as usual and then connect the accelerator rod, which is composed of similar stock, to the plate and lead it through the flooring as shown. A metal button can be threaded to the end of this







BUCHSTEIN'S FIBRE LIMB









You had the med of energies. Von haven't time. 15 mileutes over of Productator equals 2 haves to gympanions. Character Fa.S.R. The Production Co., 343 Advance Mag., Cleveland, O. rod and can be removed when neces-

sary to take up the flooring.

When the hand throttle is closed, the two slides are against each other. But if the accelerator is pushed down, that opens the carburetor also, one half the sliding rod pushing over the other, thus not disturbing the hand throttle in the least. When the accelerator is released, the spring pulls the carburetor shut to the original points hald by the hand throttle.

Slight adjustments will be necessary when assembling, but, once made, will be found to operate as well as the bought ones.—Windson Crowell.

A Mirror that Will Reflect Hidden Engine Parts

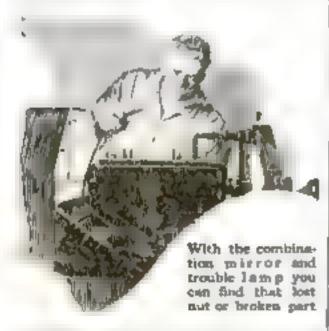
INFORTUNATELY our eyes are not like those of the lobster, mounted on long posts and sticking out of our heads. If they were we should have little trouble seeing into a transmission or engine cylinder. Since we are handleapped by nature's mistake, we must make the best of the situation and use tooks or devices to suit the occasion.

Illustrated below is a combination mirror and lamp, which can be used for inspecting the inside of the engine, the transmission, or the differ-

ential

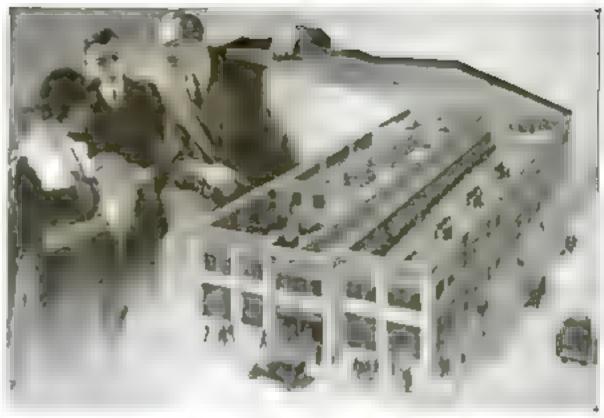
The mirror should not be more than 2 in. in diameter, the lamp bulb a regular six-volt and operated from the storage battery

There are two features to be considered in making the device. First.



flexibility, and second, illuminating qualities. Obviously the light will be of but little use unless it is mounted on a flexible tube. The ordinary armored cable cover, or flexible metal gasoline hose of small diameter answers the purpose very well. With this sort of tubing, the light and mirror may be put into almost inaccessible places and conditions inspected.

The second point to be considered as the location of the light bulb. If the bulb is located below the mirror, on the tube, it will shine in the eyes of the operator. The best location is shown, at the top of the mirror, where it can be shielded from the operator's eyes, yet give maximum illumination.



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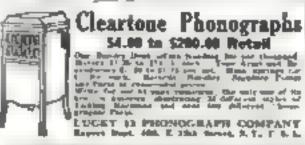


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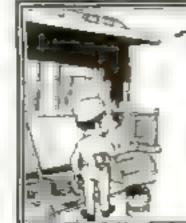
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A Turntable Handles Heavy Parts on a Work-Bench

WHEN heavy articles, such as cylinder blocks, fly-wheels, storage batteries, etc., are being handled on a work-bench, considerable effort is required to constantly turn them about and back and forth for inspection and alteration. Consequently a



A turntable mounted on a work beach will greatly and the mechanic in turning houvy parts in the position desired

turntable attached to the bench would be a labor-saver and a convenience for the workman.

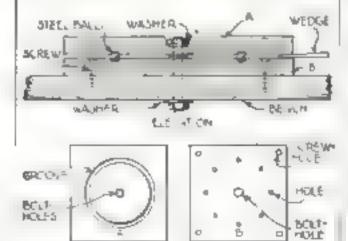
To make such a turntable, procure two blocks of hard wood of the required size to handle your particular kind of work. A fair size would be 15 in, square by 2 in, thick

Select a position on the bench little used for general work and use this for the turntable.

Bore a hole in the center of each block through which a large bolt can be inserted. Then lay out a circle on one face of each block, the same diameter

in several points about the circle on block B drill shallow holes with a tapered or round bottom. take block A and center it upon a lathe-chuck and, with a round end cutting tool, turn a shallow groove which will coincide with the holes in block B when they are laid together, centers matching.

Fasten block B to the bench with four long screws or bolts. Set sufficiently large automobile bearing-balls in each hole in the top of the block, so that when the groove of block A is



DETAIL OF BLOCKS SHOWING BALL RACE

Two blocks of hard wood are required to make the turntable. Ball-bearings. act between them make it turn easily

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as it is used

Commercially

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By J. D. ADAMS

Here at last to a book that develops a practical working familiarity with the alternating current the form in which electricity is used in every home. The author thems have the can be done in an interesting and inexpensive way. It is surprising how very fix of these regard in the electricity trades trained the is sublitting for the 110-volt, 60-cycle current it is mist to my that a very amail per en age of the electricians can close a sention the

of the electricians can clearly employe the print of the efficient can clearly employe the print of the efficient a certainty employed that a precise a endroit who has studied electricity to whose our give you a clear ideal of the other particles. of the atternational ou rent

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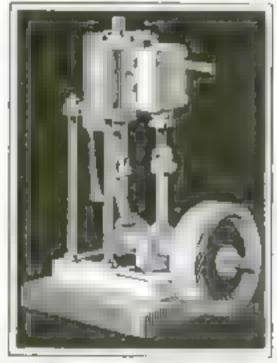
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MAKE MODELS Start a Home Workshop

Model Making by R. F. Yates deher navueled of mode dusting one e amendanes seems and box s author sarried gones. The answer sevent of a many are offer the dear arrange manufacture will be a unto do hard soldering I will be a e -a 6 K wift soldering lathe work, tempering, drilling, pattern making, etc.

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inverted over them, they will elear the surfaces of the two blocks by a fraction of an inch. Previous to this fill the holes and groove with grease.

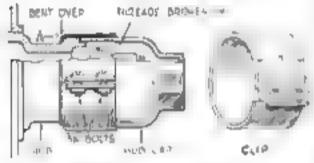
Bore a hose through the bench to correspond to the center holes in the blocks and pivot the whole affair together with a large bolt and weahers as shown in the detail. Countersunk the head of the bolt in the upper block A.

With this arrangement heavy weights can be turned in any direction with a minimum of effort. To set the table at any point so that it will remain rigid, aimply force a narrow metal wedge between the blocks as Ehowa.

How to Fit a Hub Cap When the Thread is Broken

NE of the most annoying of the petty accidents that happen, is to knock off a hub cap by grazing a gatepost or other obstacle.

This usually means nothing more than fifteen cents for a new cap, but



When the treads are stripped on your car's hub cap, you can make an emergency repair

occasionally a piece of the thread is broken out at the same time

This happened to me one winter when, owing to the ice-covered road surface, I skidded into a fence, knocking off a front hub cap and part of the thread as well. I found that there was not enough thread left to hold a new cap in place. The service-station man said that the only possible repair was to get a new hub body, costing \$2.50. However, not wanting to go to that expense, also wanting to keep the mud and rain out of the ball races, I made a repair in the following manner:

A piece of metal 156 in. wide by 6 in, long was procured from a junk-pile, and best into the form of a chp that would clamp tightly round the hub cap, two 3 16 in. stove bolts being used. to tighten the clip.

The cap and clip are put in position on the hub with the edge of the clip projecting over the edge of the depression in the hub body as shown. The clip is then tightened up and its overhanging edge knocked down with a light hammer

This will make a good solid repair and if the hub cap is filled with grease the bearing will be as weatherproof as

Examine the clip every now and then to see that the bolts have not become loosened or that the cap is not leaking grease.

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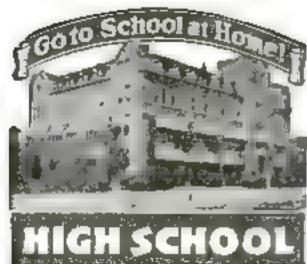
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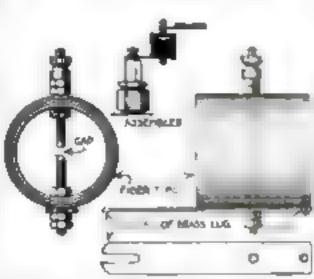
Spark Intensifier THERE are many auxiliary spark

intensifiers or spark-gaps on the market at present for overcoming spark-plug trouble and increasing mileage in automobiles. These can be used just as efficiently on stationary or motor-boat engines. But where the commercial article costs hearly four dollars for a set of four, the home me change can make such a set for practically nothing.

An Efficient Homemade

The body of the intensifier consists of a section of fiber or hard rubber

The fiber is preferable, as it is better able to withstand the heat of the



This spark intensifier enables you to discover the spark-plug that is not firing

engine. For this purpose use tubing about 1 in, inside drameter and cut each section 114 in. long. Drill two holes 1/8 in. In diameter through oppozite sides of the section, exactly in line with each other. Then drill a third hole, somewhat amaller, near one edge and in line, on one side, with one of the holes. That makes one hale in one side of the tube and two holes in the side opposite it.

Next, remove the threaded steel rod comprising the sparking terminal in the porcelain of an old spark-plug. Cut it in half and blunt one end of each piece. Now Insert one piece of this rod in each of the opposite holes in the fiber section. Lock in position with nuts removed from spark-plug assemblies as shown, so the rounded ends are separated about 1/32 in., possibly a trifle more. This will have to be determined by experiment after the intensifier is put in operation.

Between the two underneath nuts and the fiber is placed a stiff brass strip with a slot in one end. The slotted end projects beyond the fiber far enough so it can be attached to the spark-plug. The opposite end is screwed to fiber through the third hole previously mentioned.

The connection of the lutensifier with the spark-plug is shown. By arranging each section so the opening faces the side on which the hood is usually lifted, the driver can always watch the spark jumping across the gap and can thus determine instantly any cylinder that is not firing properly.

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Save Your Spare Tires by Covering Them

AUTOMOBILE tires are wrapped I in paper by the manufacturer because tire-makers know that sunlight and air sap the strength of rubber. The tire should be protected until it actually goes on the rim for road Bervice.

Statistics prove that a tire good for an average of 5000 miles when it eaves the factory will lose approximately 2000 miles of life by being carried, unprotected, as a spare for one year.

A tire cover made of rubberized conted fabric will outlast many tires. It will cost less than the 2000 lost mileage on one unprotected tire.

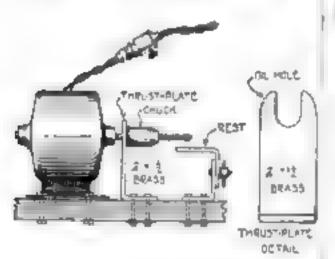
Neatly covered tires look so much better hanging on the back of the machine than do bare tires. covers are waterproof and can be washed without injury as often as the car is washed. They come in colors to match the body finish.

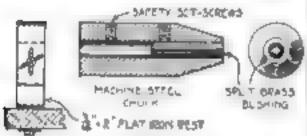
There'ore, both from the standpoint of appearance and economy, "cover your tires to save your spares" is good, sound advice.

Using the Electric Motor for Reaming and Drilling

MANY a hand job in the shop which takes a long time can be done with a small electric motor in one fourth the time, provided one knows how. Here is the way to do it.

Remove the motor's pulley and make a chuck, as shown at the top of





are the details for adapting your electric motor to reasoning and drilling jobs which were formerly done by hand

the illustration, using safety setscrews for the jaw and screw. Interchangeable bushing split longitudinally with a hacksaw forms fine iawa which will hold a bit firmly.

Reamers may be used and the chuck can be replaced with an emery-wheel and the rest moved up to it by interchangeable bolt holes. For light bench work the motor works fine.

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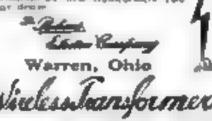
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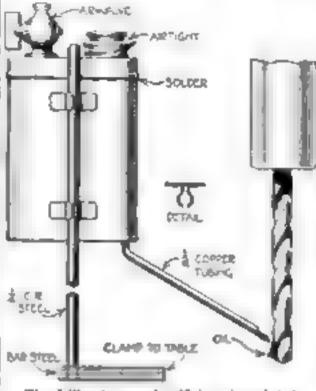
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A Lubricant Feeder for a Drill-Press or Lathe

HE illustration shows an easily I made container to hold oil or other lubricant and which can be either clamped to the table or work on a drill press or other machine, or which can be arranged to ride along on the tool slide of a lathe. A small tin can of rectangular shape is obtained, a



The drill point gets hot if there is no lubricant constantly pouring upon it. Here is a way to make a feeder deliver the oil

bram air-cock or priming-cup, a short length of copper tubing about 8/16-in. in diameter, a piece of 31- or 5/16-in. cold-rolled steel, a short square bar of fron or steel, some pieces of heavy sheet brass, and the screw top from a smallsized automobile-lubricating oil-can. This latter should have a cork bottom on the plug to insure an airtight joint when the plug is screwed home.

A hole is cut in one end of the cover of the rectangular can and the fillingplug soldered in; then the air-valve is soldered in the other end as shown in the illustration. The copper tube is soldered into the bottom of the can at any convenient point, using plenty of solder to make a secure joint. Four bruss clips are cut and bent up and soldered to the can, being adjusted to hold it by friction at any point on the rod. At the same time it may be easily shd up and down as required. The top of the can is then soldered on, running the solder all around and through the joint, then blow into the can and test it to make sure there are no air leaks, for the flow of oil is to be shut off by closing the air-cock and any small air leak elsewhere would prevent this. The upright rod is screwed into the square bar and by means of a "C" clamp this bar may be clamped to the drile table or tool-slide.

To use the device, open the airvalve, take out the filling plug, and fill the container with lubricant; then screw the plug tightly in, close the aircock and adjust in position on the machine so that the oil-pipe will deliver the lubricant at the proper

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position over the tool or work. When the machine starts, open the airvalve and the lubricant will start to flow and its volume may be regulated by closing the valve to the right degree.

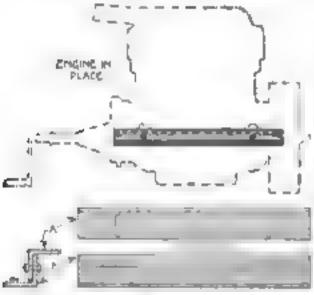
If desired, a more substantial and better-looking oil-feeder could be made up from heavy brass and a special filing plug fitted, though the externporised one shown in the illustration

will work as well as any.

Make a Motor or Engine Bed of Pieces of Angle-Iron

AFTER a motor or engine is set up on the foundation, the belt stretches or the shafting works out of line. This often necessitates moving the position of the motor a trifle and is an awkward task and an expensive one if the fixtures are set solidly in place. To make the process more simple, a sliding base should be made as shown. This is made of two lengths of angle-fron and bolted to the base [tself

Cut two pieces a little longer than the motor or engine base. One, A



A good aisding base for an engine or motor can be made from two pieces of angle-iron

(the top member), has two slots cut crossways of the top face, placed the right distance apart to accommodate the anchor-bolts of the machine base. The bottom member, B, has two slots cut parallel to its length. Belts from the upright face of A slide in these alots and make it sasy to change the position of A with reference to B.

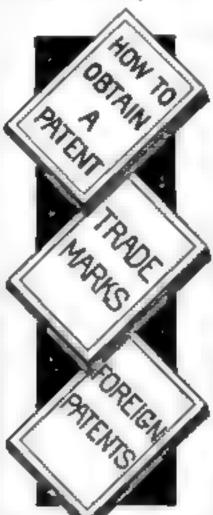
Section B is bolted to the foundstion and A is loose bolted to B as just mentioned. Then the machine is fastened to the top faces of A. Two sets of these should of course be provided, one for each side of the machine.

If the machine is out of line with the shalt pulley, the bolts through the top of A are shifted. If the belt grows slack, move the machine back by loosening up on the boits in B, taking up again when adjustment is made.

The simplest engine bed is, at best, difficult of construction. However, if the mechanic follows the foregoing instructions, he will find no difficulty in setting up the engine or motor in such a position that it will not vibrate

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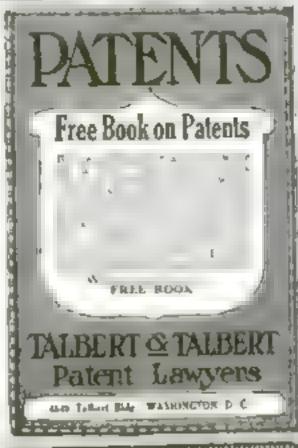
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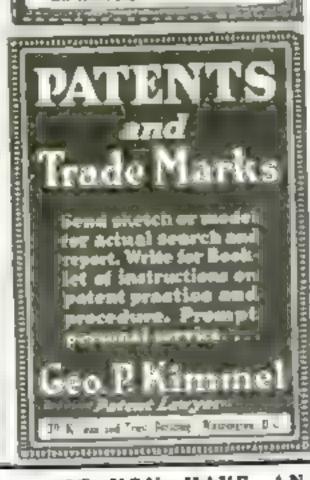
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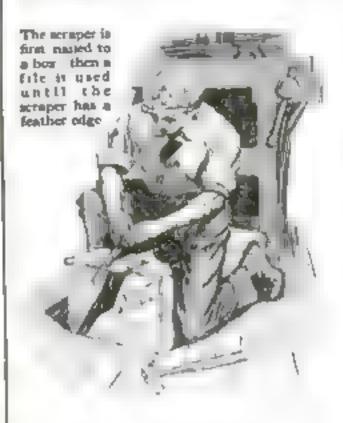
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How to Sharpen a Scraper Properly

SOME one, some time, told me how to sharpen a scraper for floors or cabinet-work that will last a long time and insure a perfect cutting edge.

You are familiar with the ordinary blade used for such purposes—size 3 by 41- in. Place it flat side down on a box of convenient size to sit upon, allowing the end to project about an inch, drive three or four shingle-nails into the box close to the biade, and bend them over to hold the blade perfectly rigid. Take a flat file and,



sitting astride the box, make a long bevel until you get a feather edge, being careful that it is equare, or you may round the corners a trifle. Remove the blade and place it in the clamp, procured for this purpose, using a wrench to set up the nuts.

Fasten a nall-net on the other end of the box with staples or nails. Now, holding the clamp in both hands, bever side of blade down, slightly tilten toward the operator, draw it across the nail-set, first one way and then the other, allowing it to slip off the nailset to insure turning the edge throughout its length.

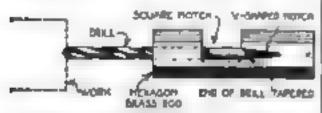
One needs to use considerable force in order to turn the edgs, which should not exceed 1 16 in. Less than this

will do. In the next step take an old file or a new one-very fine-passed lightly over the feather edge to make it smooth. A scraper so sharpened will improve with use. As soon as it fails to cut properly run the file along the top, holding the blade perpendicularly in the left hand, cutting edge toward you, and then with the small end of the file book it under the turned-over edge, lifting up and pulling it across two or three times, this last act lifting up the edge.

If the blade has been properly turned, it is quite possible to use it for two or three hours by occasionally drawing the file across it. -M.S. LORD.

A Holder for a Center Clearance Drill

A VERY simple and handy tool for machinists, especially for those not supplied with combination centering drills, is shown in the illustration. The tool consists of a piece of bexagon breas with a notch cut out as shown, a V-shaped opening cut in the center with a backsaw, a hole



A piece of hexagon-shaped brass with a V-shaped opening makes a good drill-

drilled to receive the shank of a drill, and a center hole drilled in the opposite end. The hexagon shape affords a ready grip for the hand. The dotted lines show the work when the holder is in position for use after being centered. The straight shank of the drill is ground tapering like a chisel edge to fit into the V-shaped notch cut in the holder .- W. H. UNDER-Woob.

An Efficient Driver of Carpet-Tacks

BRIEFLY, the driver consists of a which alides back and forth within a brass tube. A bushing at the upper end of the tube prevents the rod from coming out, and the handle keeps the head from going farther than the lower and of the tube.

Procure a seamless brass tube 10 in. long with an inside diameter of 7 16 in. A steel rod, 3 16 lp. and 8 in. long is then found and each end threaded. On to one and is screwed a cast-iron handle of any suitable size after it has been tapped and a steel head two inches long and small enough to just fit inside the tubing tapped and screwed to the other. The rod is of a



A single push of the handle through the tube drives the tack home in the carpet

length which will bring the shank of the handle even with one end of the tube and the bottom of the head with the other, and should be exact to work

A brass bushing made of a short length of smaller tubing or hard wood is then inserted into the upper end of the tube, held fast with short screws through the sides. If the bress bushing is used, it may be burred to fit tightly and thus do away with the |

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By Lionel Strongfort

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LICKEL STRONGFORT

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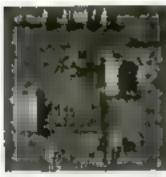
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necessity of screws or rivets. The rod in then inserted and the handle and head screwed tight.

Magnetizing the head is easily done by rubbing the face of it over a permanent magnet. The better the steel used, the more lasting wall be the magnetic influence, but the head may be re-magnetized as often as it requires it. Once a season will be sufficient.

This driver is very simple and is easily manipulated. To facilitate the task of laying the curpet, a pine board 1 ft. long and 4 in. wide was cut and a number of nail holes made in it over its surface with a sixpenny nail to a depth of 14 in. Preparatory to the carpet-laying, tacks were set into these

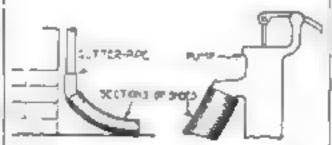
In laying the carpet, one hand may be kept at the edge of the carpet, holding it in place and preventing any slack while the other operates the tackdriver.

Grasping the top of the tube and handle in the one hand, a tack is picked from the board, and setting the bottom of the tube over the proper point, the tube is released, at the same time raising the handle. A single drive of the handle downward will drive the tack home, and another tack is picked up and driven by the same operation. It will be seen readily that this method easily supersedes the usual method, but this took has only to be made and used to be thoroughly appreciated.

Some New Uses for Old Automobile Tires

TNSTEAD of selling all your old automobile shoes for junk, why not make some use of them about the home? Lumber and metal piping cost money today, but sections of tires can be used for water-troughs and apouts to good advantage.

A section about 114 ft. long placed under the gutter-pipe from the roof



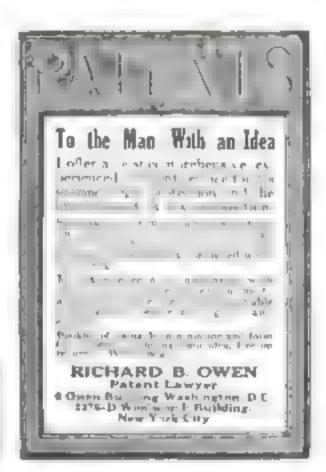
More uses for old tires appear every day. Here is a way to save buying metal piping

will serve to lead the water away where it will not wash out the underpinning of the house.

Likewise a short piece slipped over the spout of the pump can be used to lead water into a trough without Several sections lapped together can be made to conduct water a considerable distance.

These are only two uses for old tires, and, as the illustration shows, they are made to serve excellent purposes. Does this article suggest other uses to which an old tire may be put?

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A Pocket Voltmeter in an Old Watch-Case

THIS is a very accurate instrument, and can be made by even a boy, from materials found in or around the workshop. The case from any old "dollar watch" will do, though a No. 18-size case is to be preferred.

After you have found a suitable case, make a permanent magnet by bending a thin piece of steel into shape, as shown in the illustration. On the

Inside of the legs place the pole pieces, which should be made of soft iron and attached to the magnet by a small screw in each.

Then you ranguetize the magnet by rubbing briskly on an ordinary horseshoe mag- waternet. Then attach the magpat and pole pieces to the case by means of two small makener wife serews, such with leather washer for Lomulation.



An old watch-case and a home-wound coil will make a pocket voltmeter

The next step is to make the moving part of armature.

Bend a thin strip of aluminum into the shape of a hollow square; wind with small magnet wire. The pointer (which may be one of the old hands of the watch, or a thin piece of steel) comes next. Solder it to the end, at right angles to the direction of the wire. Then set the moving part in the watch-case by soldering two bearings or jewels of the old watch to a strip running across the watch, but insulated from the magnet.

Attach a spring to each end of the frame so that, as it revolves, one spring is wound and the other unwound. This will keep the moving part balanced. Attach a fine, covered wire to each spring and run out through the stem socket of watch-

Now cut out a scale (celluloid or cardboard) and glue to top of the magnet.

Your voltmeter is now completed, with the exception of the calibration, which you may accomplish by testing one or more batteries with a standard voltmeter (found in any garage or machine-shop) and noting the spot on the scale of your home-made voltmeter. By changing or tightening the springs, any desired size of scale can be made.

Also, the above will answer for an ammeter, by merely changing the scale.—Delbert Adams



The Sargent Auto-Set

Cuts True Cuts Fast

ASK any carpenter about the Sargent Auto-Set Bench Plane. Inquire about its cutting qualities and about its auto-set feature. He will tell you that it is a dependable tool with a big time-saving improvement in the self-adjusting sets.

The cap and clamp of the Sargent Auto-Set Bench Plane are fitted together as one piece, with a set screw to regulate

the position. Another set screw adjusts the cutter.

Sargent Cylinder Day and Night Latch

Put it on doors—inside and outside, front and back—that you want securely barred. An ordinary mornes lock is "easy pickings," but a cylinder latch keeps the introder outside. "Press the button" to dead lock the bolt or hold it back, as desired. "Pull the button" to release the bolt. Belf-locking—closing the door eprings the latch.

in a few seconds and assembled as quickly. Cutter and cap go back exactly in the same position as before.

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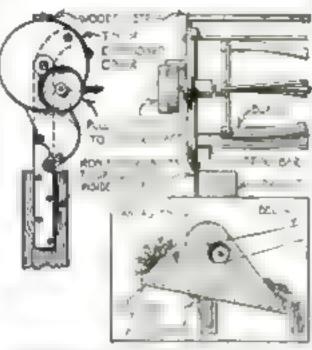
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Convert Your Lawn-Mower into a Feed-Cutter

IN these days of high-priced farm machinery a satisfactory greenfeed cutter of medium small capacity can be built out of an old lawn-mower, provided the blades and cutting-but are not past usefulness. The accompanying illustrations show, in a way, how thus is done, but should not be taken as conclusive, as the make and design of lawn-mowers differ. Their differences, however, are not radical, and the adaptation of any one of them for the previously mentioned purpose will follow somewhat after these sug-



Details of the process that converts your lawn-mower into a green-feed cutter

gestions. The suggestions are broad enough so that any one with a little mechanical ingunuity can use his particular mower to cut green feed, either by hand or by power.

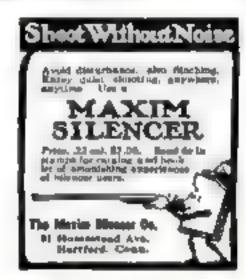
First, disamemble the lawn-mower to the extent of taking off the drivewheels, the roller, and the handle This leaves the mower frame with the blades and cuttingbar intact.

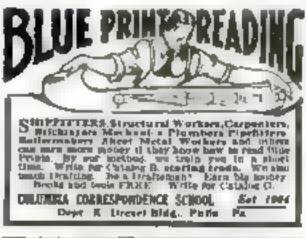
Erect two wooden posts so that their outside faces will be slightly closer than the distance between the insides of the mower frame. Now set the mower upon the tops of the posts so that it rests upon the roller alides as shown. Then measure for two long sheet-from or sheet-steel supports, which can be boited to the outside of the posts and to the inside of the mower frame so as to hold it rigidly in this position. The exact style, size, and shape will depend upon the style of mower you are using, but will probably be somewhat like that shown in detail.

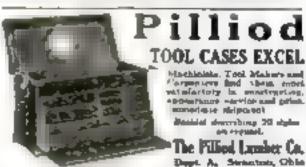
If no handy bolt- or screw-holes occur on the inside of the mower frame to attach the support to, some will have to be drilled and tapped. When the supports are finally secured so as not to interfere with the turning of the blades, bolt their lower ends to the posts. If supports are solid enough, they should hold the mower rigid and not allow undue vibration.

Drill and tap two boles in the top









Convert your Bicycle into a Motor Cycle by mains a STERFEY MOTOR ATTACHMENT Fite may ord mary buryle diamond arch or trace frame Easy to attach On the market over 20 years. Send stamp for circular and full per-Beulars at once

and back side edge of each side of the frame, as shown, to which screw two strips of wood. Then cover with sheet tin or heavy cardboard as a shield to prevent the cut fodder from flying.

Set as large a pulley as possible on the free and of the knife shaft. If the drive-wheel stud interferes, saw it off. Pulley must be large enough to drive the blades easily against the cutting pressure when under a load.

Next, build an inclined wooden platform to not on the top of the posts and close under the cutting-bar. Incline it so that the material goes in under the blades where they strike against the bar instead of leaving it Cover each side of the mower, from the top down, with heavy canvas, attaching the bottom edge to the sides of the platform. The pulley should be allowed to be outside this cover. This will entirely inclose the apparatus and leaves an opening front and back for the material to be pushed in against the cutters and to pour out at the rear after being cut.

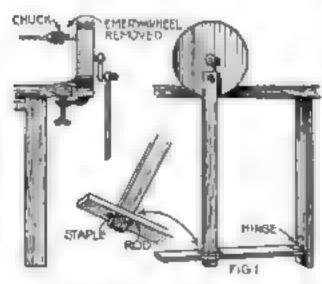
When using power, drive the cutters just fast enough to make a good clean eut.

This apparatus is good for clover, hay, alfulfa, straw, etc., for chickens and small stock feed.—Thorton Hallett.

The Emery-Grinder as a Drill and Lathe

THE illustration shows how an old l emery-grinder was made into a serviceable drill and lathe after the surface of the emery had become badly worn and uneven.

The shaft which originally held the emery was removed and threaded to take a small chuck, not unlike those with which small hand-drills are



Here is a way to transform a decless emerygrinder into a drill and lathe for amall work

equipped. The bearings were then rebabbitted and worn parts and play taken up with bushings, and the parts reassembled again.

As shown in Fig. 1, the drill was attached to the edge of the bench, and connected to a pedal, hinged to one of the legs of the bench, by means of a pitman made of a hard wood stick. The length of the pedal and its height



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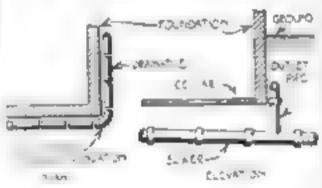
from the floor were governed by the height of the bench and the length of the handle of the emery-grinder.

The pitman was connected to the pedal as shown. A rectangular hole was cut through the pedal slightly larger than the end of the pitman. The pitman was then run through the hole, and a small rod was run through the hole bored in the pitman, held to the under side of the pedal by means of two large staples.

A 2-in, block set up and braced in front of the chuck at the proper distance, completed the device. It was made adjustable, and operated with a lever arm, so that the work could be moved toward the drill as the bottog progressed .- DALE VAN HORN.

How to Build a Dry Cellar in Clay Ground

OSSIBLY one of the most annoying places to build a house that is free from cellar water is in clay ground. It seems that no amount of careful and painstaking construction of the foundation will keep out the water. However, there is at least



A drain constructed in this manner will carry off all water from your cellar

one way that proves very successful and that way is made clear in the illustration.

The tile is laid out so as to have it slope gradually to the outlet pipe, which empties into the sewer. The drain tile is the same as that used on farm lands, but, of course, a four-inch tile is the largest that would be advisable. - RAY BAARMAN.

Trolleying the Well Water to the House

COMETIMES an idea or method is o old that it is new. This method of raising water from an outside well to a room in the top story of a house was in use in Italy in the sixteenth century and even before that, but it is so simple and ingenious that it may find a place in modern rural life. The method, as explained, is the same as the original. but is constructed to use modern appliances.

Drive a post in the ground near the far side of the well-curb and drive an eyeholt in the top. Then erect a crane over the window of the house where it is desired to raise the water and set an evebolt near the end as shown.

Just back of the eyebolt bolt a large pulley to the crane. This can be of





Don't haddats or feel timid, simply said the sult back, we cant to you. It where full was pathy first successful me in refunded at annu. SAMPLES PREE

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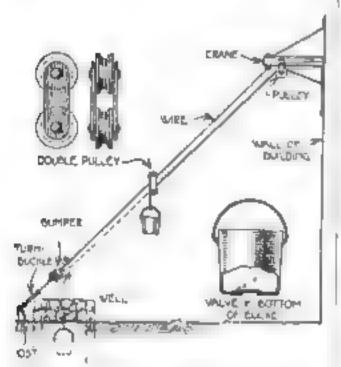
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PARE TAILORING COMPANY





any suitable pattern. The two eyebolts just mentioned are then connected with a wire cable on to which has been stung a double pulley somewhat of the pattern shown in detail. This should be large enough to run free on the cable without the possibility of running off the wheel and cramping. Just back of the cepter of the well put some solid metal substance



This apparatus carries the water from the well to the kitchen, thus saving many weary steps and insuring a good supply

as a bumper to stop the progress of the double pulley. This can be set in the cable any convenient way. A turnbuckle should be placed at the post end of the cable. Then, with everything in place, draw up on the turnbuckle until the cable is taut.

The bottom of the bucket should be arranged as shown in detail. This consists of cutting a round hole in the bottom about 2 in. in diameter. Over this hole, on the inside, fasten a leather flapper which will close when water inside the bucket bears against it, but will raise up when the bucket is being lowered into a body of water outside. The deck-leather of a common pitcher pump will do very well as a valve for this purpose.

Tis a rope to the center of the buil of the bucket and reeve it over the lower wheel of the double pulley and the wheel on the crane, and your "water elevator" is complete.

The action is obvious. The empty bucket descends the cable by gravity When the double pulley strikes the bumper it stops, but the bucket descends the well, fills itself through the valve in the bottom and is ready to be hoisted to the window. As it is raised, the ball strikes the double pulley and the whole is pulled aloft

A counter weight on the free end of the rope will assist in raising the full bucket if desired.

Once you justall this device, you will use it constantly, for it means getting rid of that tedious and hard job of carting water to the house by hand, and the necessity for economy in the use of water will be done away with.



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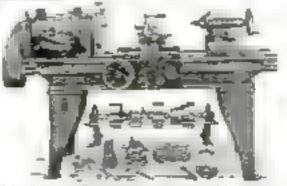
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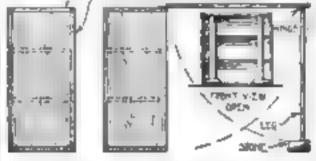
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A Combined Box and Table for Campera

SINCE a very small table must here shown, which takes up no additional room among the equipment, will be found very desirable, and it can be set up in a moment after un-

HUNGEY LEW MARKS IN AND COVER CLEMEN



Set on the running-hourd or in the tonneau of a car this box will accommodate all the camping uzeralla

packing. A strong box is procured of dimensions approximating 28 to 30 in. in length, 24 in. width, and 1 ft. or 14 in. in depth. Such a box will hold the ordinary light camp equipment, and will easily fit under the seat of a spring wagon or in an automobile.

The lid is binged to the how at one end, while at the free end two legs of 1 by 3 in, lumber are hinged to the lid so as to fold against it inside when the lid is closed. These legs are of the same length as the inaids measurement of the box. The binges used are ordinary butts, so that the entire lid and one end of the box form a table of a convenient

A division board inside the box will form a convenient shelf when the box is set on end .- H. P. GRINSTEAD.

Hold Two Pens Parallel with a Clamp

DRAFTSMEN who have occasion to draw many lines in parallel will appreciate the little device illustrated herein by which they can set two common ruling-pens in position to do this. Several of these devices arranged for different widths will

SPERMS ! THO BULLING PENS

METAL

You can draw two lines instead of one by using this clamp enable any one to draw parallel lines different distances apart by simply changing the pens from one to the other.

Get a piece of spring metal about an inch long and fully as wide. Then bend it in the shape indicated so the two semicircles will

clamp each penhandle securely

Set the pens in place with the points at the same level. Then, when you hold one pen against the rule and draw it along the paper, the second pen will duplicate the line given a dustance away.



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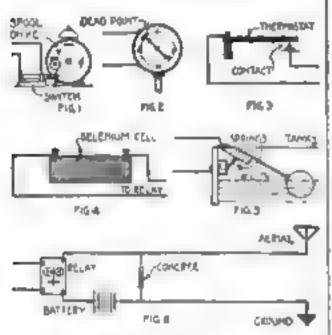
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Siz Ways of Automatically Stopping an Engine

WHILE there are many schemes Y for automatically stopping a gas engine or electric motor, the methods bere described will be found to serve nearly every practical purpose. They will be found advantageous in cases where the engine cannot be closely watched and tended, as in pumping water at a distance, shutting off when a certain pressure has been reached,

Fig. 1 Blustrates the manner in which the sparking circuit can be broken at a certain time of day. It is done in this instance by attaching a cord to the handle of an easy working knife switch and arranging it to be wound up on a drum, which is like the spool that revolves with the winding



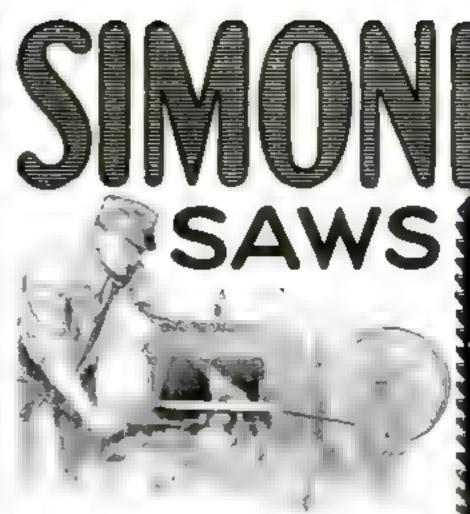
Here are all ways of stopping an engine or motor automatically

key of an alarm clock. As the apool revolves with the ringing of the alarm, the cord winds up and lifts the switch out of contact.

Fig. 2 shows a gage—steam, water, or air-with the hand in constant contact with the metallic face. This completes the circuit to the engine. At the maximum pressure, however, the hand strikes a spot of non-conducting material and the circuit is broken.

Fig. 3 illustrates a thermostat in the line. Suppose the engine is driving air into a large retort forge or furnace and when the best reaches a certain degree the blust must cease. Arrange the thermostat so that the points are always in contact as long as the heat remains low. Then as the temperature rises, the arm rises, until at the proper degree of heat the points separate and the current ceases, stopping the power.

Fig. 4 operates by the action upon selenium. There may be conditions where the engine should be stopped when a certain amount of light is obtained, or at daybreak. Suppose an engine is to be run each night and must be stopped at daybreak. selectum cell is placed in a primary circuit. Selenium, being a poor conductor in the dark, keeps the circuit open until daylight comes in. Then



Hack Saw Blades

Simonds-Made Hack Saw Blades are the most economical to use: they cut with less resistance, remove no more metal than necessary, and wear the longest.

This superior saw service is primarily due to the Simonds Steel that's put into these blades. It is a steel especially made and toughened for hard cutting service by an exclusively Simonds process developed in their own Crucible Steel Mill.

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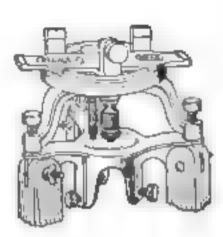
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STANLEY IMPROVED LEVELING STANDS

A Stanley Leveling Stand, used in connection with a wood or iron level, and a pair of level sights will be found in many cases a very satisfactory and inexpensive substitute for the more expensive surveyor's instruments.

By its use one can readily determine levels from a given point to one at a distance, such as locating or setting the profiles for foundation work, ascertaining the proper grades for drains, ditches, etc.

It can be placed on a stake or crowbar and adjusted to a horizontal position, even though the stake or crowbar may not be exactly perpendicular.

As now made it can readily be attached to a tripod.

STANLEY RULE & LEVEL CO. New Britain, Conn. U.S.A the conductivity changes and the circuit is closed. This, by operating a relay, opens the sparking circuit.

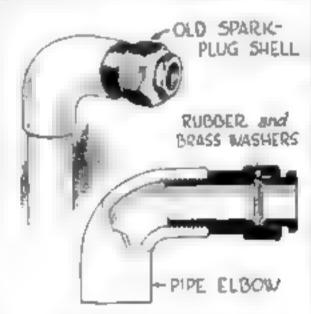
Fig. 5 is a more familiar method and consists of arranging a float in a tank so that when the maximum water level is reached the contact of a switch attached to the float arm is broken, and the engine is stopped.

Fig. 6 is a method of stopping an engine from any distance which can be reached by wireless. An aerial is connected to a relay and battery. In the circuit is placed a coherer. When the key is closed at the sending station, the coherer is induced to close that circuit and the relay operator to open the secondary circuit and the engine stops. This may be increased in efficiency according to the user's demands.

In case an electric motor is to be stopped, the controller handle must be held in place by a magnet, and when the magnet circuit is opened, a spring pulls the motor switch back, out of contact.

A Water-Pipe Coupling Made of an Old Spark-Plug

OLD Necessity certainly is the mother of invention, as I am perfectly willing to admit since my experience of a week ago. One of the joints in my house water-pipe system



How to make an old spork-plug serve as a water pipe coupling

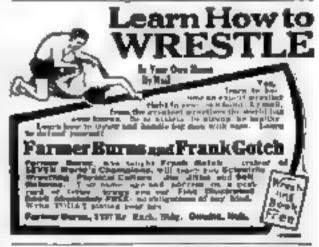
had rusted badly and sprung a leak. I had taken the Stillson wrench to tighten it, and of course split the elbow just when water was badly needed. There is but one cut-off valve for the whole house and it was not practical for me to turn this off for any length of time, or until I had obtained a pipe plug, so I hunted about for a substitute.

As soon as I realized that sparkplugs are threaded with half-inch pipe-threads, it took me but a minute to remove the porcelain from an old one, fit a rubber washer inside the porcelain retaining hushing, and hold it in place by a small from washer. The old spark-plug still answers the purpose of a pipe-plug, and the water was turned off less than half an hour.—F. L. AVERY. Popular Salance Aroning







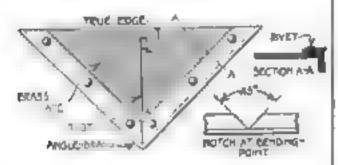




How to Make a Tool for Centering Shafts

THE exact center of a shaft or disk can be found almost instantly with the aid of the tool here described, and the result will be perfect if the tool is carefully made. The dimensions of the tool will depend upon the needs of the maker, but one tool will handle work of all sizes up to its maximum capacity.

Take a piece of angle-brass and cut out at the center a plece of one flange, making the sides of the cut



If you wish to find the center of a shaft or disk, use this tool

exactly at right angles. Bend the ungle-brass until it forms a right angle. See that the brase is perfeetly straight and true from every angle.

Cut a triangular piece of sheet brass, making a right-angled triangle that will just fill in the frame of bent angle-brass; the metal need not be more than 1/82 in. thick, unless the tool is a large one, when 1/16 in. will be more satisfactory.

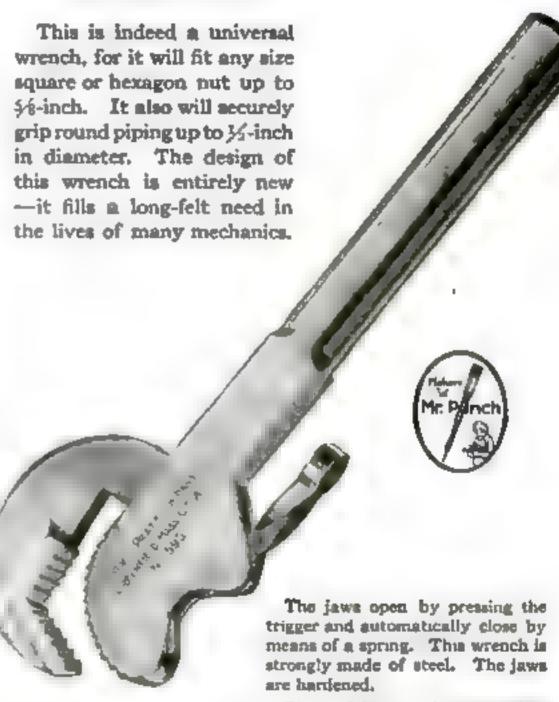
Rivet the sheet brass in place in the frame, countersinking the rivets on both sides, or, if desired, the rivets may be counterwank only on the inside. A smooth job looks better, however, and the countersinking is necessary on the inside.

Now very carefully and accurately bisect the right angle and scribe a sharp, deep line from the corner to a point near the wide edge. Then cut out a long slot, one edge of which must coincide exactly with the scribed line; this edge is the working edge and must be perfectly straight and exactly halfway between the legs of the frame. The width of the slot may be anything desired.

To use the tool, rest the end of the shaft to be centered, or the disk, on the flunges of the angle-brass; scribe a line on the shaft, using the true edge of the slot as a guide; turn the shaft at right angles and scribe another line. The point of intersection of the lines will be the exact center of the shaft if the tool has been accurately made. To test for accuracy, turn the shaft to several positions and scribe several lines. If all intersect at exactly the same point, the job has been well done. If not, you have been a little careless somewhere, and it will be necessary to do some work with the dividers to find out where the working edge of the slot departs from the exact bisection of the right angle.



Chauffeur's Universal Wrench No. 595



The usefulness and adaptability of this wrench are characteristic of every one of the 1500 Goodell-Pratt Tools. Skillful tool designing has always been a feature which Goodell-Pratt Tools were noted for. In combination with the use of only the best materials, it is responsible for the bonest tool value of the 1500 Goodell - Pratt Tools.

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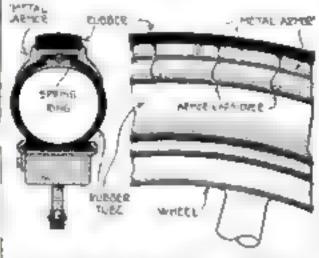
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You Cannot Puncture This Kind of Tire

IN the collective detail view of this tire, the parts fit together in the order shown and form a complete armored tire having no inner tube. Metal sections or armor scales extend about the sides of the rubber tube and afford protection against puncture.

The extreme outer section, or part next to the ground, is a solid rubber



On account of the classicity of the tire, the armored acctions are made so they will glide over one another

band or outer tire. The inner section is a spring ring placed within the tubing, the tubing being split for the purpose. As the spring ring has considerable supporting power, as well as resiliency, the pneumatic pressure in the tube can be quite low.

The different parts are screwed and clamped in such a way that air at low pressure will not escape. It will be seen that the upper portions of the split tube are squeezed between two metal parts, thereby forming an airtight juncture. Attachment of the complete tire to the wheel is made by any of the usual clincher methods, there being nothing particularly new in that part of the construction.

Steadying a Loose Lead in a Pencil

OFTENTIMES the artist or draftsman is troubled by the lead in even a good pentil working loose in the wood so that the least pressure of the point upon the paper will push it out of sight. This is annoying, to say

the least, especially when pencils are scarce at the time. To remedy this is a simple matter.

Sharpen the point of a small thum b-tack very sharp and force it down



A thumb-tack in the lead channel prevents the lead sliding

the blunt end of the pencil between the lead and the wood. Be careful not to place it between the seams of the wood, because it is apt to split the pencil.

This is a simple stunt, but one well

worth knowing.



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How to Make a Salt-Water Aquarium

A SALT-WATER aquarium should be made from one piece of glass. It should be 12 in. high and at least as wide. A salt-water aquarium is much easier to make and maintain than a fresh-water aquarium. The bottom receives a few inches of beach sand or pebbles, according to the character of the creatures to be introduced. This must be washed until the wash water is not discolored or dirty. The salt water is procured from the ocean or it is prepared artificially.

Artificial sea-water contains

Bodium chloride 2 08 per cent.

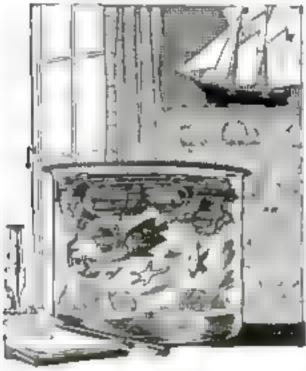
Magnesium chloride 0 32 per cent.

Potassium chloride 0 05 per cent.

Magnesium sulphate 0 02 per cent.

Calcium sulphate 0 15 per cent.

Although sea-water evaporates, the salts remain in the solution, and if



If placed in a strong light, the water in the aquartum will turn green

evaporation is prolonged, the ealts in the water become so concentrated that life cannot exist in it. It can be seen how essential it in that the original proportions remain constant, therefore frush water is added for all that which has evaporated. And, in order to keep the concentration as uniform as possible, the height of the original sea-water is marked when it is placed in the aquarlum.

Then fresh water need only be added whenever the water sinks below this

For aeration, use the green like commonly known as sea lettuce. This is the most satisfactory marine plant as well as the most easily obtained. It does well for many months, but it must finally be replaced by fresh specimens. These plants are placed near the surface of the water to a depth of 5 or 6 in. This allows a small clear space near the bottom of the aquarium for a few marine animals. Be careful not to overstock the saltwater aquarium and be sure to remove all decaying material at once, to prevent the fouling of the water.

Nine-Foot Saws Running 130 Miles an Hour

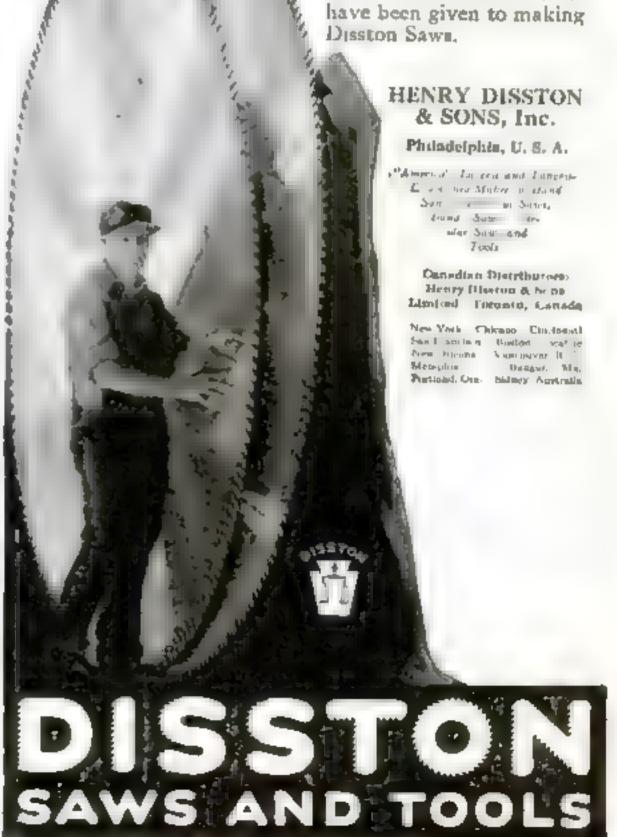
No one had ever built a saw nine feet in diameter. It took 80 years' experience and unlimited courage to do it. Men who were supposed to be saw experts said:

"You can make a saw as big as that, but the strain will be too great; no mandrel would hold, and 63 square feet of saw surface couldn't run straight and true at the tremendous speed demanded."

But two such saws were completed and installed in the Coats Shingle Mill at Hoquiam, Washington. Before a large gathering, many of them intensely skeptical, the saws made their initial run.

And they ran perfectly! The skeptics became enthusiasts as the gigantic saws—the biggest in the world—slashed through giant logs with a swift, clean cut.

It was the obvious thing for these saws to bear the Disston name, to be of Disston-Made Steel and made by men whose lives and whose fathers' lives have been given to making Disston Saws.



Use Machines like Good Tools

However fine the took you may be using, your eye watches the results, and by that you make expert use of the took.

Much the same with a machine:—when you can watch the results of its working, you can run it efficiently with an expert control of production.

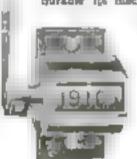
Just as your eye guides you in the use of a hand-tool, the records of



guide you in machine operation—by registering the amount of work and the variations due to mechanical causes or operating-methods.

The small Revolution Counter below registers one for a revolution of a

shalt, recording a machine operation. Though small, this counter is very durable its machanism will stead a



very high rate of speed, making it especially suitable for hight fast-running machines and most adaptable to esperimental work. If run backwists, the counter subtracts, Price \$2.00. (Cut meerly faill size.)

The Set-Back Rotary Ratchet Counter below is for the larger machines, such as punch present and metal-stamping machines, where a reciprocaling movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as allustrated, \$11.50—mbject to discount. (Cot less than 3% size.)

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The Veeder Mfg. Co., 44 Surgount St., Hartford, Conn.

Have You a Step-Saving House?

The Popular Science Monthly will pay ninety dollars for the best answers

HOW do you save steps in your home? What arrangements or what appliances have you made that save time and reduce work that would otherwise have to be done by hand?

The Popular Science Monthly wants to know just what practical and useful things can be constructed to make every house a step-saving house. For instance: a concealed laundry chute would interest us, if it weren't so old; a space-saving cupboard—another old one. No patented or marketed appliances will be considered.

The Popular Science Monthly offers three cash prizes—a first prize of \$50, a second prize of \$25, and a third prize of \$15 to be awarded in accordance with the rules set forth below.

Rules Governing the Contest

(1) Contestants are not limited to the number of step-savers and time-savers, but only one method can possibly win the first prite, only one the second, and only one the third. The contest is open to everybody.

clearly either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably type-written, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p. m. on Friday, December 31, 1920.

(5) The judges of the contest will be the editors of the Popular Science Monthly. (6) The first prize of \$50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best method for saving steps in the house.

The second prize of \$25 will be paid to the contestant who submits a method next in merit.

The third prize of \$15 will be paid to the contestant who submits the method third in ment.

(7) The winners of the contect will be announced in the earliest possible issue of the Popular Science Monthly. A description of the methods which win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts which do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one method, the descriptson and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Editor of the Step-Saving House, Popular Science Monthly, 225 West 39th Street, New York City.





The Brunswick Method of Reproduction







New Tone Betterments

Demand your consideration of The Brunswick

THE Brunswick Method of Reproduction, although it has many advantages, primarily brings better tone. All its features combine toward that covered achievement.

Suppressed or muffed tones are absent. There is a roundness or fullness of expression that is quickly noted, the first time you hear The Brunswick.

The Ultona, the allrecord reproduces obtained only on The Brunswick, obtains the utmost from the record. It brings our intonations often slighted. It plays each type of record exactly as intended, being adjustable at the turn of a hand.

Forthermore, it practically eliminates so called "surface noises." For it is the only counter-balanced reproducer. It travels a cushioned path around the infinitesimal grooves of the record, its suspension so perfect that the needle follows every undulation.

The Tone Amplifier, built to conform to acoustic laws, is another feature of the Brunswick Method of Reproduction. Here again tone waves, having been reproduced perfectly, are allowed to amplify and develop naturally.

This Tone Amplifier is built entirely of moulded wood, so shaped as to permit proper vibration of tone waves. There is no clashing caused by imprisoned tone waves.

In every particular and considered as a unit, the Brunswick Method of Reproduction is one of the greatest advancements in the phonographic art. It brings final perfections, new refinements.

Your ear will quickly detect the superiority of The Brunswick. A comparison will award The Brunswick first choice.

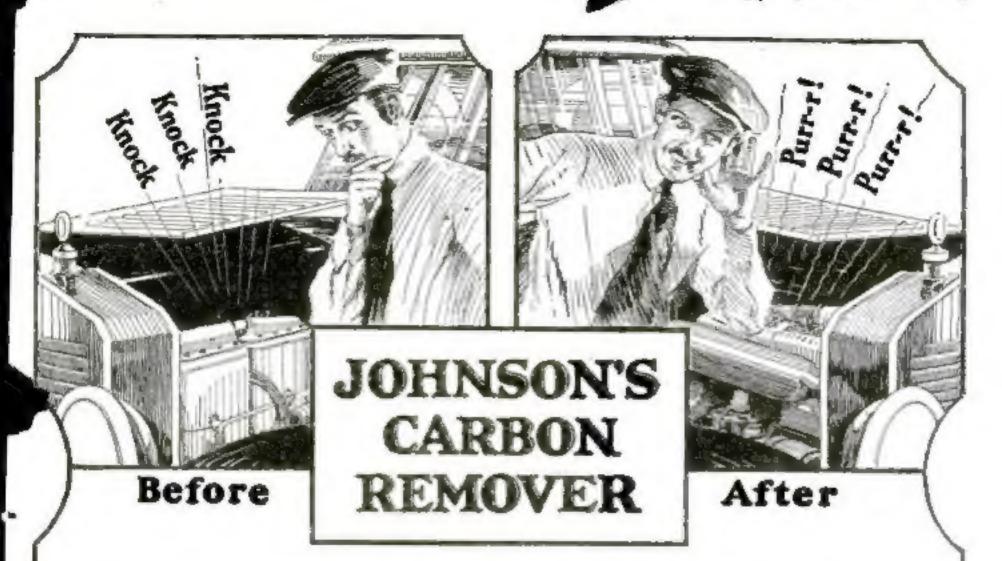
So if you seek the utmost in a phonograph, be sure to hear. The Brunswick first. Visit a Brunswick Dealer. Ask also to hear Brunswick Records, which can be played on any phonograph with steel or fibre needles.

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Porunswick PHONOGRAPHS AND RECORDS



IT is carbon that steals away the power of your engine—causes that knock—and retards hill climbing. Cleanliness is the secret of a powerful motor that will take hills and pull through mud and sand on high.

Johnson's Carbon Remover is the easiest, cleanest, safest and most satisfactory remedy for carbon. It will save you \$3.00 to \$5.00 over other methods and without laying up your car. No experience or labor required for the use of Johnson's Carbon Remover—you can easily do it yourself in ten minutes—without even soiling your hands—and the cost is trifling.

Prevent Carbon Accumulations

You can keep your motor snappy and full of "pep" by **preventing** the accumulation of carbon. Don't wait until your motor is choked and caked with it. Use Johnson's Carbon Remover every 500 miles, then the carbon is removed when it is soft and powdery, eliminating frequent grinding of valves and keeping the motor always clean. Half-pints—75 cts. in U. S. East of Rockies.

Johnson's Car Savers Will Keep Your Car Young

The depreciation your car suffers depends largely upon yourself. If you run it without any attention you sell at a big loss. But with a little time, care and JOHNSON'S CAR SAVERS you can cut the depreciation in half. There's a JOHNSON CAR SAVER for every purpose—no experience is required for their use—and they can all be applied by the average motorist with perfect satisfaction.

Johnson's Radiator Cement—scale leaks in two to ten minutes—in liquid form and easy to use. Half-pints —75 cts. in U. S. East of Rockies.

Johnson's Block-Loc—the perfect top dressing. Easy to apply — dries in fifteen minutes — is permanent, waterproof and inexpensive. Half-pints—75 cts. in U. S. East of Rockies.

Johnson's Auto-Lab—enables you to revarnish your car one day and drive it the next. Pints—\$1.00 in U. S. East of Rockies.

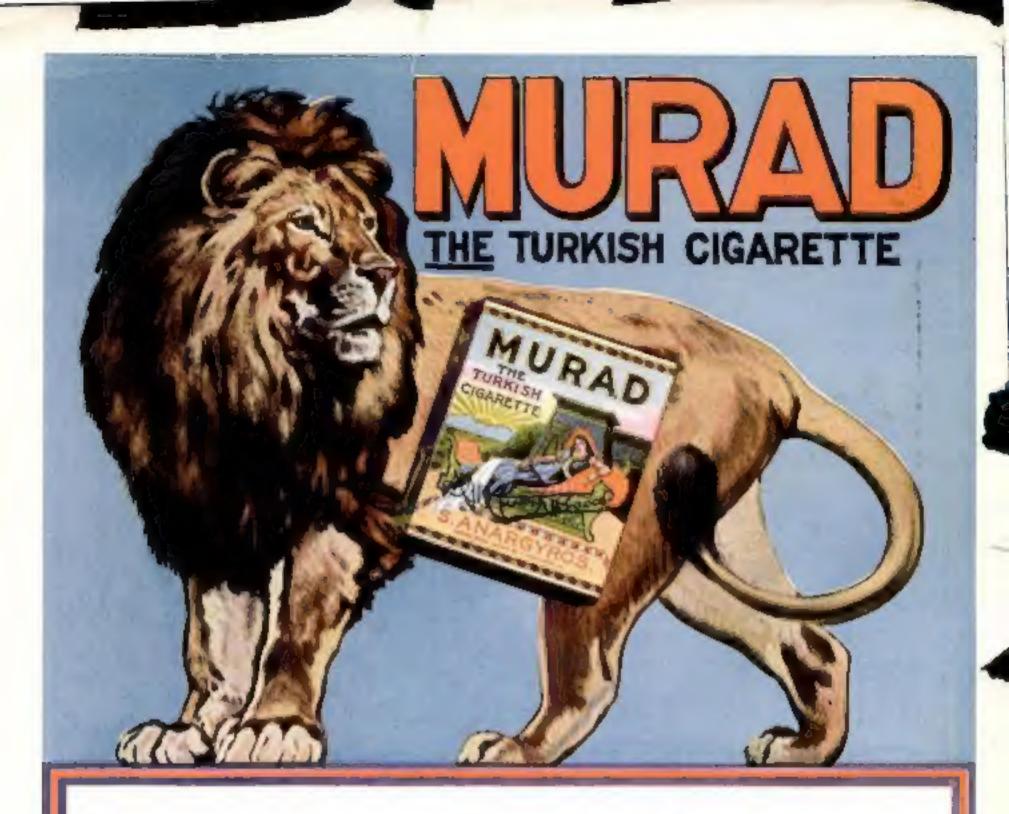
Johnson's Cleaner—will remove scum and grease and make body, hood and fenders look like new. Half-lb. cans—45 ets. in U. S. East of Rockies.

Johnson's Proposed Was—for polishing body, hood and fenders—it preserves the varnish and protects it from the weather. Helf-pints—50 ets. in U. S. East of Rocki.

Johnson's Stop-Squeak Oil—a wonderful spring lubricant. Reduces the liability of spring breakage. Half-pints—35 etc. in U. S. East of Rockies.

Insist upon your dealer supplying you with JOHNSON'S CAR SAVERS. Don't stock or use unknown brands. Write for our booklet on Keeping Cars Young—it's free.

S. C. JOHNSON & SON, Racine, Winconsin, U. S. A. Canadian Factory—Brantford, Ontario



Mrs. Fox was bragging one day about the large number of her cubs.

"How many cubs do you bring into the world at one time?" she asked the Lioness.

"Only ONE," replied the Lioness - "but it's a LION."

MURADS COST 20 CENTS for a BOX of 10—BUT THEY'RE MURADS!

MURADS would be lower priced if we left out all or part of the 100% Turkish tobaccos of the purest and best varieties grown—or if we substituted inferior grades of Turkish tobacco.

But they wouldn't be MURADS-they'd only be Foxes!

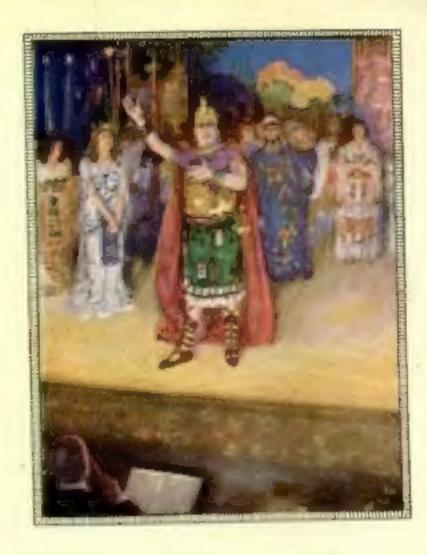
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Makers of the Highest Grade Turkish and Egyptian Cigarettes in the World





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When you hear the greatest artists in your own home on the Victrola, you experience the same thrill of delight that comes when attending their actual performances. You hear the same famous artists just as they are-just as they want you to hear them-when you play their Victor Records on the Victrola. The records made for the instrument. The instrument made for the records.

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